HAER
ARIZ
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EAST RIM DRIVE
(Grand Canyon Route #1 and #10)
Between South Entrance Road and east park boundary
Grand Canyon National Park
Coconino County
Arizona

HAER No. AZ-44

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
P.O. Box 37127
W&ashington, D.C. 20013-7127

HAER
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HISTORIC AMERICAN ENGINEERING RECORD

EAST RIM DRIVE
(Grand Canyon Route #1 and #10)
~~(Grand Canyon-Desert View Road)~~
HAER No. AZ-44

Location:	The approximate 25.4-mile scenic road begins at its intersection with South Entrance Road southeast of Mather Point and continues generally east to the east park boundary, Coconino County, Arizona. UTM A: 12 3990075 400480 /S. Entrance Int. UTM B: 12 3988800 425540 /Desert View UTM C: 12 3984790 427660 /E. Park Boundary Phantom Ranch USGS Quadrangle, 1988 Desert View, Arizona USGS Quadrangle, 1988
Date of Construction:	1927-31
Type of Structure:	Scenic roadway
Use:	Scenic Roadway and east entrance road
Designer/Engineer:	U.S. Department of Agriculture, Bureau of Public Roads (BPR). U.S. Department of Interior, National Park Service (NPS).
Builders:	James Vallandingham, Salt Lake City, UT Pearson & Dickerson, Riverside, CA
Owner:	NPS, Grand Canyon National Park (GCNP)
Significance:	The scenic drive is an early example of the cooperative agreement between the NPS and BPR to build quality automotive roads within the national Parks. Extant features of East Rim Drive representative of these early efforts include pullouts, parking areas, and road spurs which offer scenic views; easy road grades; minimal landscape scarring; and rustic style retaining walls.
Project Information:	Documentation of East Rim Drive is part of the NPS Roads and Bridges Recording Project, conducted in summer 1994 under the co-sponsorship of Grand Canyon National Park and HABS/HAER. This report was researched and written by Michael F. Anderson, HAER Historian, September 1994.

INTRODUCTION

The approximate 25.4-mile East Rim Drive begins at its intersection with South Entrance Road and runs east, generally near the Canyon's south rim, to Desert View, then descends the Coconino Plateau to the east boundary of Grand Canyon National Park. As constructed in 1927-31, East Rim Drive replaced various old wagon roads which, in combination, allowed tourists staying at Grand Canyon Village to access scenic views at Grandview Point and Desert View. During the 1930s, the road was extended from Desert View to the east park boundary as a part of a new approach road from Cameron, Arizona. This final 3.5-mile segment was initially termed Grand Canyon Route #10, and later, the East Entrance Road, though neither name gained popularity nor made the pages of any tourist brochure or map. Today, maintenance crews consider the entire highway from South Entrance Road to the park's east boundary to be one continuous East Rim Drive.

East Rim Drive is and always has been considered one of two scenic drives along the south rim of Grand Canyon (West Rim Drive is the other, see HAER No. AZ-42), but the Bureau of Public Roads and National Park Service designed and built the main roadway some distance from the Canyon rim. East Rim Drive, more than its counterpart to the west, exhibits the principle of an interior road with spur roads northward to viewpoints of special value. This concept allows visitors to enter and exit the park quickly along an alignment chosen for easy grades, maximum radius curves, and longest possible tangents, while spur roads and pullouts (where the roadway brushes the rim at the heads of several side canyons) offer fourteen points from which to view Grand Canyon.

HISTORICAL CONTEXT

When the National Park Service assumed management of Grand Canyon National Park in 1919, they inherited a network of insufficient, ungraded dirt roads. All roads leading to Grand Canyon from the south, east, and north had been built or worn in the years 1883 through 1915 by tourist operators who were concerned only with the passage of horse-drawn stages and wagons. Roads within the park, other than the macadam-paved Hermit Rim Road, resembled these early approach roads. Summarily, the typical park road in 1919 was an 8'- to 12'-wide sinuous set of wagon tracks through terrain spotted with dense ponderosa pine forest, shallow but steep gullies, and frequent Kaibab Limestone outcroppings. All were dusty in summer and impassable in winter or following any measurable rain.[1]

The road which developed from Grand Canyon Village to Grandview and beyond to Desert View between 1896 and 1915 proved no



Figure 1. Small segment of the old wagon road out to Grandview Point, 1913. This road was typical of those within the park from 1883-1915. (GRCA Image #16021, GCSC)

exception. Its original purpose stemmed from the establishment in the 1880s and 1890s of tourist facilities in the area of Grandview Point by Canyon pioneers John Hance, Philip and William Hull, Pete Berry, and J. Wilbur Thurber. In 1895, Thurber took over operations of the Flagstaff-Grandview stage line which began operations in 1892 over a road first developed by the Hulls in the 1880s. In 1896, Thurber erected a tourist tent camp at the site of Grand Canyon Village and extended the wagon/stage road to that point. This extension followed Long Jim Canyon westward and on to Rowes Well, then north to his camp at the rim. Although the early road could hardly be considered a rim drive, it was the earliest version of a road between Grandview and Grand Canyon Village.[2]

This stage road continued to be used by visitors from Flagstaff and those travelling between Grand Canyon Village and Grandview into the 1900s and 1910s. Although motorists began to visit the Canyon in the 1910s, private tourism operators did not upgrade the existing route to automotive standards. By 1913, however, they did "construct" a new segment which left the old road west of Long Jim Canyon and struck north for a more direct approach to the village. This segment, which closely followed the alignment of today's South Entrance Road (see HAER No. AZ-45), was called the Grandview Automobile Road on early maps.[3] It served not only tourists travelling east to Grandview, Desert View, Cameron, and Flagstaff, but also those arriving from Maine and Williams as the northern leg of two south approach roads. It remained in use until construction of the first true automotive roads from the east and south in 1928-32.

This study did not reveal the origins of the first road leading from Grandview east to Desert View, but there is no question that such a road existed before the NPS came to Grand Canyon. And although a continuous road from Desert View to the eastern part of the state (Cameron and beyond) did not exist before the 1930s when the east approach road was completed, the Navahopi Road--maintained by the Fred Harvey Company between 1924 and 1929--did come within 4 miles of Desert View before taking a more southerly path off the Coconino Plateau and on to Cameron. We can be sure of a road from the village to Desert View by the 1910s because Grand Canyon's first superintendent, W.H. Peters, noted in 1920 that "an excellent dirt road paralleling the Canyon for thirty-two miles east to Desert View" already existed, though the terms "excellent" and "parallel" might be considered suspect. In all likelihood, this road began as a trail worn by any of the early pioneers--including Seth Tanner, Bill Bass, and John Hance--as early as the 1880s. These same men, or others who engaged in marginal mining operations and who needed to haul ore out and supplies in, probably upgraded the horse trail to a wagon road.

It is doubtful the road ever received maintenance to automotive standards until the arrival of the NPS.[4]

Superintendent Peters favorable assessment of the road to Desert View notwithstanding, GCNP superintendents raised annual protests with the NPS director over the condition of most roads within and approaching the park during the 1920s. They pointed out that motorists' visits escalated each year and there simply were no automotive roads within or approaching the park. In the 1926-27 travel year, 63,000 visitors arrived at the south rim in some 25,000 automobiles--the first year in which more tourists arrived by auto than by the Grand Canyon Railway--but not a single road had yet been built. By that year everyone was aware of the need, but until funds became available, park forces had to maintain as best they could the dirt roads they had inherited.[5]

Meanwhile, the road out to Desert View received what improvements park road crews could provide. In 1920, Superintendent Peters reported that the "El Tovar-Desert View Road" had been widened, straightened, and graded over half its length. Superintendent D.L. Reaburn reported routine repairs in the following year. In 1922, Superintendent W.W. Crosby mentioned that the road had been maintained at reasonable expense and minor improvements made to lines and grades. In 1925, park forces reconstructed portions of the route from the village eastward for several miles. Routine maintenance and the few improvements noted for the old road could hardly keep up with the increasing number of motorists desiring a trip east out to Grandview Point and Desert View, however; the only solution lay in new roads, built to automotive standards.[6]

As a result of consistent input from the parks and effective congressional lobbying by NPS Director Stephen Mather and his assistant, Horace Albright, funds for road construction to and within the national parks began to loosen up in 1924-25. A 1925 agreement between the NPS and Bureau of Public Roads whereby the BPR would design and manage construction of park highways also bode well for new automotive standards. At Grand Canyon, this pact resulted in the assignment of BPR engineer Donald Evans, who in 1924-25 completed surveys of five projects totalling 132 road miles. One of these outlined construction of a new scenic highway from Grand Canyon Village to Desert View.[7]

HISTORY OF THE STRUCTURE

Location and Survey

Arriving at an agreement to the location of a new road to Desert View was certainly the most difficult roadbuilding process in the park's history. Among the numerous factors confronting NPS

administrators and BPR engineers were the question of improving the existing road or building an entirely new one; the park's southern boundary, which left little room between the adjacent national forest and Canyon rim to maneuver; desires and pressures of the principal park concessioner, the Santa Fe Railroad/Fred Harvey Company; and private ownership of a parcel which spanned the entire distance from rim to national forest, coupled with the owner's dislike of the NPS. These questions, conditions, and difficulties would keep varied planners busy for several years before surveys could be completed and the project go out to bid.

The question of building along the existing roadway or locating a new alignment naturally arose first. As early as January 1924, NPS Assistant Director Horace Albright, GCNP Superintendent J.R. Eakin, GCNP Engineer Minor Tillotson, and Mr. R.H. Clarkson of the Fred Harvey Company had met and agreed that a road along the rim would be undesirable and a new road should follow the old through Long Jim Canyon as far as Grandview. By the end of that year, all but Albright and Stephen Mather were convinced that an all weather road could only be built closer along the Canyon rim where it would not have to follow nor bridge numerous washes which form within a few miles of the rim. Acting Director Arno Cammerer reminded Eakin of the former agreement, and that NPS Chief Engineer Goodwin had proposed a rim road in the latter part of 1923 which had been rejected. Eakin, somewhat miffed at Cammerer's attitude, wrote back the reasons for the change, and reminded Cammerer that Goodwin's location followed snugly along the Canyon edge; the suggested alignment (prepared by engineer Tillotson) only touched the rim briefly near Yaki Point and a few other points to the east.[8]

Among these three alignments--the current road, Goodwin's, and Eakin's (Tillotson's)--the latter would eventually be adopted, but it took a little time and convincing to come about. Eakin in his arguments definitely echoed Tillotson's knowledge of terrain and the concessioner's desire to have a road which approached or touched at Yavapai and Yaki points. Fred Harvey and assistant R.H. Clarkston pointed out NPS plans to build the new Yaki (South Kaibab) Trail, and the obvious need for an access road. The concessioner also suggested that further developments on his part at south rim depended on the NPS building an all weather road to Desert View--and when the Santa Fe/Fred Harvey combine talked, NPS administrators listened. Stephen Mather broke the impasse in January 1925 by taking away the park's $56,000 allocation for any new rim road, putting $55,000 of it into the new Yaki Trail and allocating $1,000 for survey of a definitive alignment. In the following month he suggested to Eakin that the road should touch at Yavapai and Yaki points, but later acquiesced to spur roads to both points.[9]

Other questions which quickly arose concerned the desire for an all weather road, allotment of funds for construction, road standards, and upkeep once built. Concerning maintenance, Eakin and Mather agreed that park forces would be used for preliminary project work like clearing and grubbing and that money thus saved be spent on all manner of heavy and light equipment to facilitate that work and future maintenance. Mather knew Fred Harvey's desire to quickly build any type of all-weather road, but refused to succumb, insisting that the road would be built to BPR standards for a 16'-wide roadway and that if sufficient money could not be found the first year, funds would be allocated in the succeeding year to complete the project. While Mather, Albright, and Eakin planned for allocations, the BPR began its reconnaissance and preliminary survey 11 March 1925.[10]

BPR Engineer Evans and a party of surveyors completed their location survey in mid-April 1925. The proposed alignment from the El Tovar to Desert View totalled 24.58 miles, with spur roads to Yavapai Point (1.25 miles), Yaki Point (1.21 miles), and Grandview Point (0.85 mile). They also located a short (.087 mile) spur southward to connect with the Navahopi Road to Cameron, which would be built in 1928 but abandoned by 1932 as the east approach road from Cameron to Desert View obviated the Navahopi Road itself. Evans also revealed the final obstacle to road construction when he noted that an alternate alignment which avoided a private parcel of property would require an additional 3.36 miles of roadway over more difficult terrain. Eakin thought the difference only 1.1 miles, but in any event, the obstacle was substantial and the owner, Martin Buggeln, more of a headache than first anticipated.[11]

Early GCNP superintendents had their hands full with pioneer settlers at Grand Canyon who had homesteaded, filed mining claims, and patented those claims within the Canyon and along its south rim. Most of these men felt (understandably) they had a proprietary interest in the Canyon and disliked NPS controls over land use and concessions. Martin Buggeln was no exception. Buggeln had arrived at the Canyon before the turn of the century and operated the Bright Angel Lodge for the Santa Fe Railroad. For years he sided with the railroad in its battles against Ralph Cameron and directly competed with the adjacent Cameron Hotel & Camps for tourist dollars. In 1906 he gave up the fight (twenty years before Cameron did the same), bought John Hance's 160-acre homestead along the rim east of Grandview Point, built a hotel which he never opened to tourists, and settled with wife and children into a quiet life of ranching. In 1925 he was still there, still straddling the park from rim to national forest boundary, and still not fond of the National Park Service.

Park forces began to clear for the new roadway on 24 April 1925, although NPS administrators and BPR engineers had not yet decided on an alignment near Buggeln's property. First, they sought a legal opinion as to whether the property could be condemned, but determined that they lacked "authority in law," not to mention money to compensate for the takeover. Although Buggeln stated he did not want a road through his property, Superintendent Eakin felt that if he was not pushed by threats of condemnation he might agree to a right of way. Gentle persuasion was tried and by the end of the year Buggeln had agreed to the right of way as long as his property line along the national forest remained unfenced and he was allowed to capture and store water that flowed north onto his homestead. This informal agreement lay dormant for two years as the NPS staked and cleared the roadway and tackled challenges of funding and expanding the park's southern boundary to ensure that the entire road remained within its jurisdiction.[12]

The NPS finally programmed funds in early 1927, but when Eakin tried to pin Buggeln down to a firm agreement through deed restrictions, he balked for reasons park administrators did not understand. The cost and inconvenience of building around the property would be great, and the NPS assumed Buggeln wanted the road to run near his property, so they tried a ruse. They "let it be known" that the road might not be built if the right of way was not forthcoming. Buggeln, who understood from the early Cameron-railroad wars more about deception than the NPS could ever know, did not fall for it, but offered the right of way if he were allowed to run buses over the road. Eakin recognized this as an attempt to establish a commercial enterprise and hauled out the organic act to convince Buggeln that the law required one concessioner for transportation and Fred Harvey was it. Buggeln understood, and refused the right of way.[13]

Horace Albright finally summed up the situation and outlined the solution in June 1927. In Albright's thinking, the park service really did not want to go through Buggeln's property because

> we would have upwards of a mile of road along which Buggln (sic) could operate any kind of cheap business. He could sell lots along the road for all kinds of business enterprises.... Furthermore, we would be acknowledging at this time defeat at the hands of a man who has never tried to cooperate with us. In other words, the principal objection I have to building through his place... is that the landscape of the park would be very greatly impaired.[14]

Albright continued that even if it did cost an extra $37,000 to build around the property and required nearly a half mile of 8

percent grades, the alternate alignment should be surveyed and a BPR-standard road built. As it turned out, Abright's and Eakin's suspicions were correct. Buggeln later admitted to Superintendent M.R. Tillotson that he planned to spend $10,000 on improvements (recall that he already had a hotel, never used as such) and that he was going to operate a hotel whether the NPS liked it or not. The park service subsequently refused all his requests for permits, would not allow him to advertise within the park (and would resist his advertising on other public lands), and denied his requests to charge for scenic drives along the rim. In the end, Buggeln went back to his cattle business and forgot about tourist developments.[15]

Deciding to go around Buggeln's property meant that the road would have to pass through Tusayan National Forest for a distance of about 1,000 feet (Station 798+83 to 809+60 on the survey), and this presented problems of jurisdiction and maintenance. Eakin craftily laid the problem on the doorstep of the Coconino County board of supervisors who promised to condemn the property for a right of way (something the NPS no longer wanted) or to construct the 1000-foot national forest segment themselves. When they ran up against "stonewall" Buggeln, they chose the latter course.[16]

Eakin must have felt cursed when he discovered that the surveyed alignment around the Buggeln property passed over two "witness trees" which marked the corner common to Sections 14, 15, 22, and 23, Township 30 North, Range 4 East (Buggeln's property was the southeast portion of Section 15; the trees stood just south in Sections 22 and 23). Eakin wrote to the U.S. Surveyor General requesting that a surveyor relocate the trees (or replace them with monuments). The district cadastral engineer responded that the whole township would have to be resurveyed, or... the park could simply replace the trees with posts to mark the corner. Eakin may well have planted the posts himself to overcome this final hurdle.[17]

Martin Buggeln is only one example (the most extreme) of the difficulties the NPS would encounter over the years with GCNP development plans versus private inholdings. Patented mining claims at Rowes Well and the Orphan Mine had ended up becoming tourist camps then nightclubs by the late 1920s/early 1930s, explaining what might otherwise be considered paranoia on Albright's part. The Orphan Mine lodge and club actually prompted Minor Tillotson in 1935 to reroute the alignment of West Rim Drive so as not to bring customers to their doorstep.

Two other private parcels involved in the East Rim Drive project, those owned by newspaper magnate William Randolph Hearst and by the Canyon Copper Company at Grandview, threatened development at the planned scenic point. As it turned out, these properties did

delay final survey of the Grandview spur road, but not for long. Hearst eventually agreed to let the road contractor, who set up his construction camp at the old public campground near the point, use surplus water stored on his patented land. The copper company remained obstinate and threw up a fence to keep the road off their property, but Tillotson simply resurveyed the spur alignment to remain on park lands.[18]

Construction

Most obstructions large and small aside, the BPR completed their surveys and organized the overall construction of a village to Desert View road in two segments. The first would consist of widening and improving the subgrade of the 1913 automotive road east of the village from Station 0+00 to 311+00 (portions of which had been graded and realigned by park day labor forces in 1920, 1922, and 1925), grading a new road from Station 311+00 to 509+00 about three miles short of Grandview, and penetration macadam surfacing of the whole. This segment also included grading of the Yaki spur road from Station 27+00 to 59+80 (Station 0+00 through 27+00 had been done by day labor forces in 1925). If the U.S. Congress had extended the park's southern boundary by late 1926, the second segment from Grandview to Desert View would have been included in the first project because all considered the entire road a first priority. Since the boundary change had not yet completed its odyssey through the legislative process, the NPS and BPR decided to include grading and surfacing of the entire new South Entrance Road instead. Immediate allocations totalled $253,000.00[19]

The BPR sent out requests for bids in November 1926 and awarded the contract to the low bidder, James Vallandingham of Salt Lake City, Utah, for $259,000.00 They awarded a separate contract for asphaltic oil to the Gilmore Oil Company of Los Angeles for $6,200.00 The larger contract allowed for grading to continue as far as Grandview, even at the risk of not surfacing the roadways, but funds were tight. The NPS was contractually committed to supply $33,000.00 in asphaltic oil, culverts, and equipment, as well as pay for engineering costs. In one of those financial juggling acts so common in the early years of NPS roadbuilding, another $65,000.00 was transferred from a Yellowstone project to handle the overruns. Ultimately, the project would cost a little more than $380,000.00[20]

In March 1927, James Vallandingham began to move his equipment on site and established his main camp at the Reed Quarry, eight miles south of the Canyon rim (near Tusayan). This quarry supplied all crushed limestone rock required for the project, but the contractor delayed until the beginning of June before he had

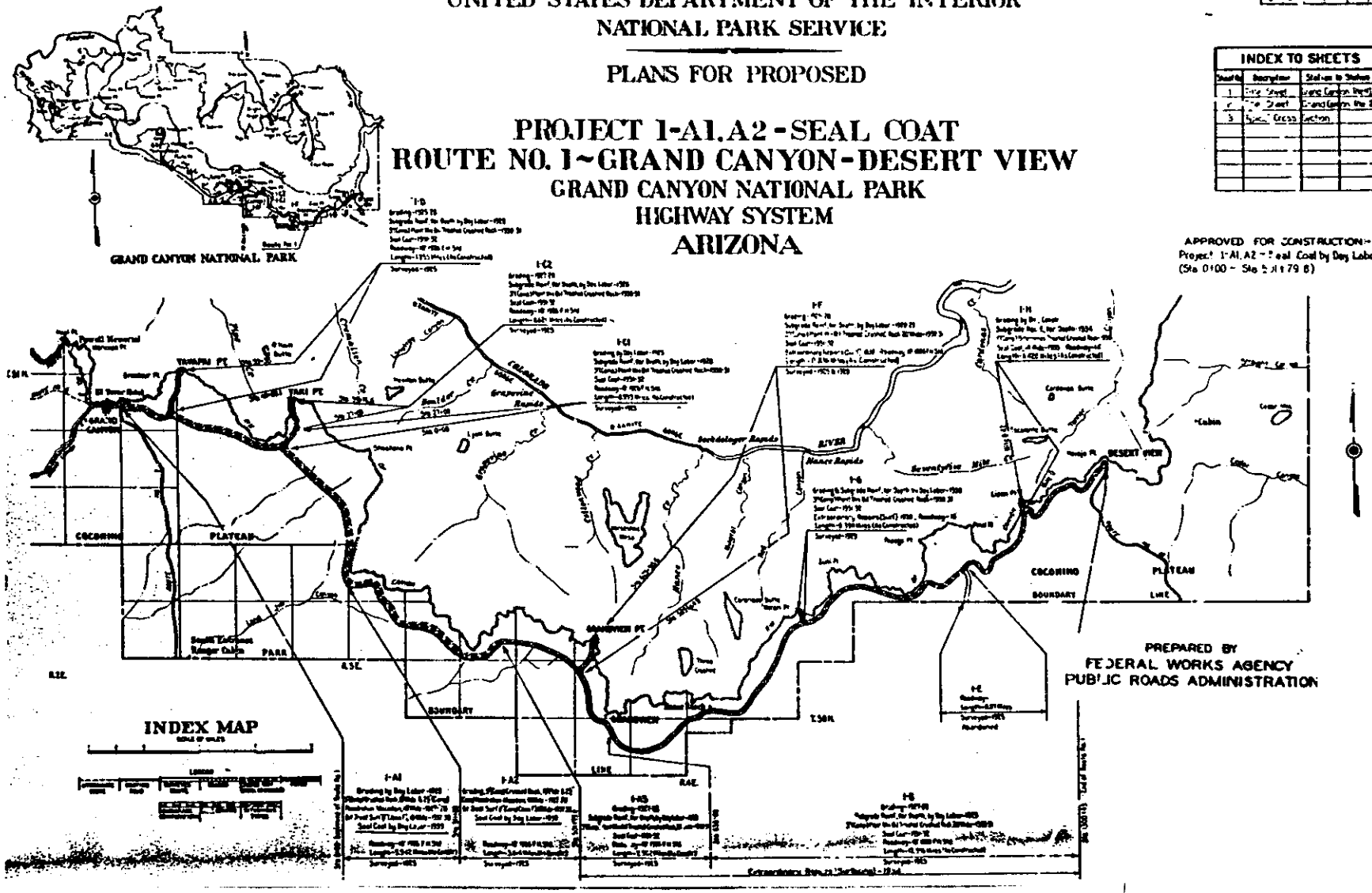


Figure 2. East Rim Drive, Grand Canyon Village to Desert View, as completed by 1935. Note the 1928 South Entrance Road on the left.



Figure 3. Road construction on Buggeln Hill, early 1930s. (GRCA Image #104, GCSC)



Figure 4-5. Above: Lipan Point spur road, graded by park forces in 1932. (GRCA Image #2927B, GCSC) Below: Desert View Loop in 1933, photo taken from the Watchtower. (GRCA Image #2916, GCSC)

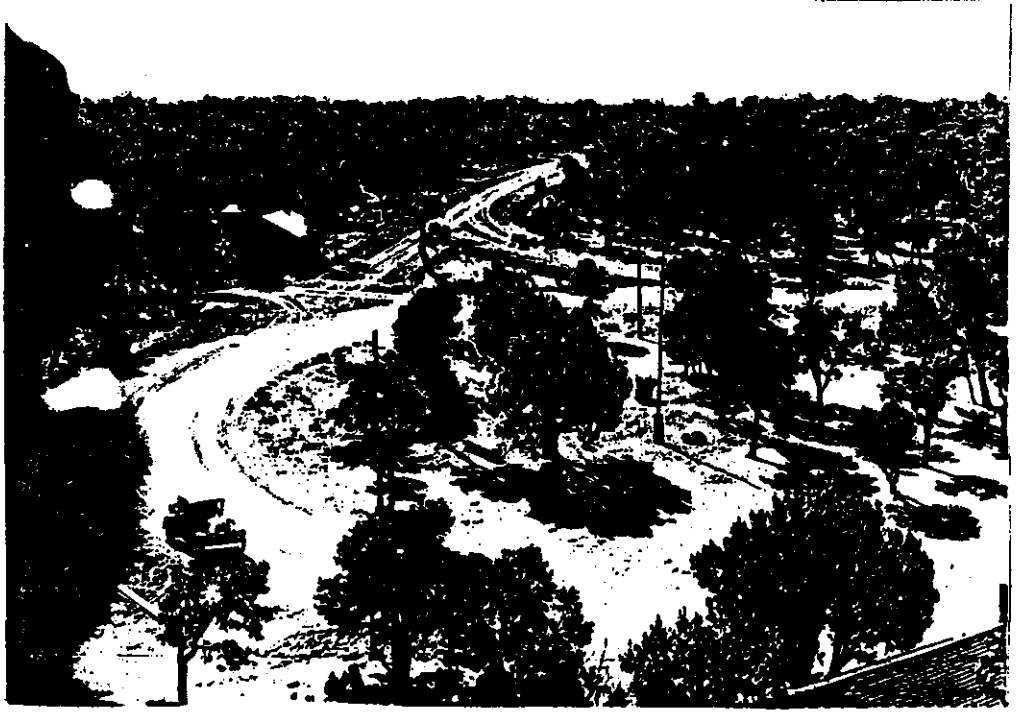




Figure 6. East Rim Drive near the Yaki spur road, October 1931. (GRCA Image #121, GCSC)

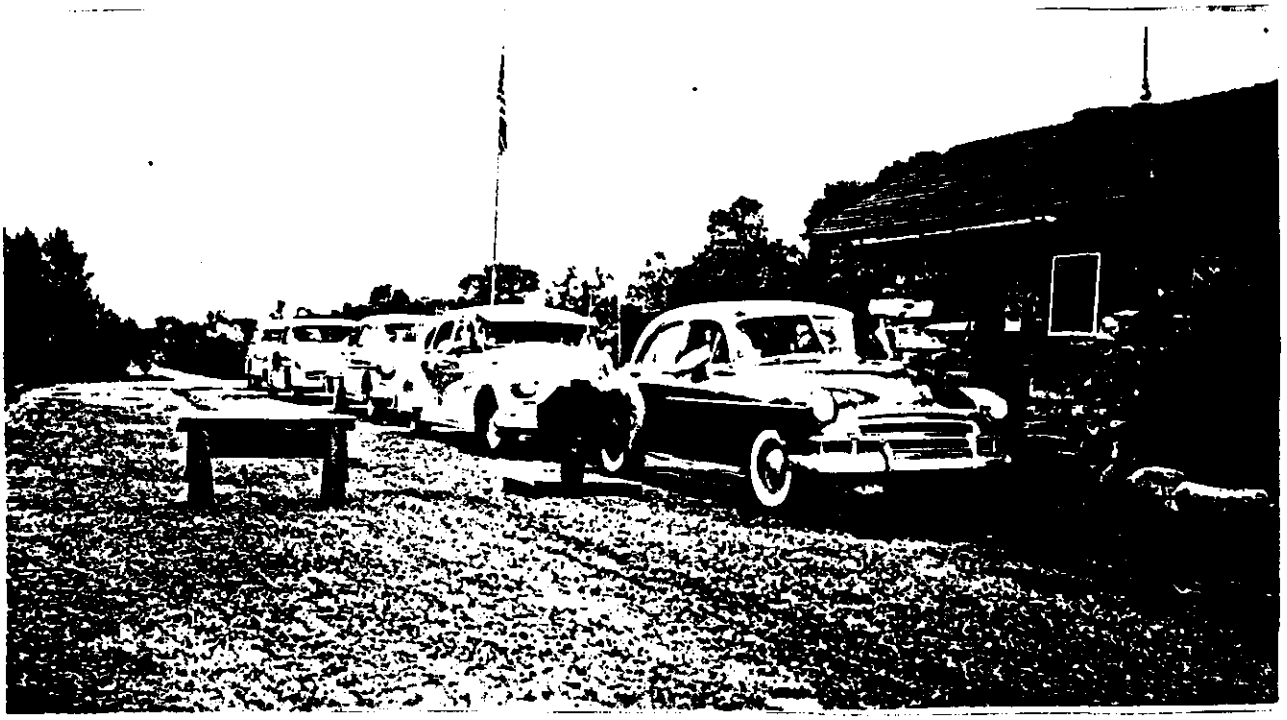


Figure 7. East Entrance Station, July 1951. This station was the first to serve the east entrance in 1933. It was replaced in 1964 with today's station. (GRCA Image #2094, GCSC)

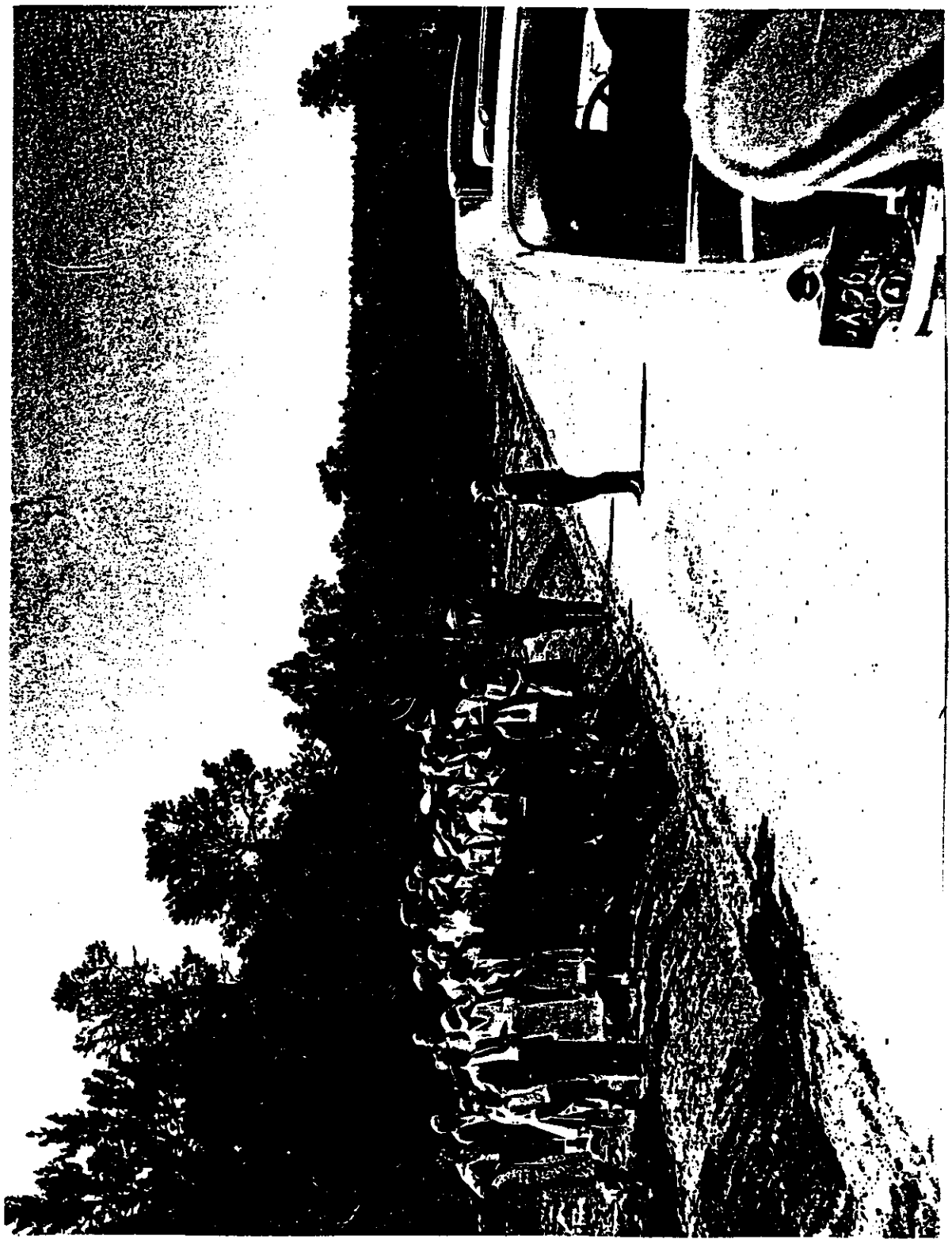


Figure 8. Ranger Pauline Mead Patraw, first woman naturalist at GCNP, leading an auto caravan along East Rim Drive in June 1931. (GRCA Image #174, GCSC)

the crushing plant up and running. Even then, progress was slow through the 1927 season as workmen broke hard limestone blocks with sledge hammers, hand-loaded dump cars, then hand-pushed the cars to the storage bunker. By the following year he moved in compressed air hammers to break up the rock and a one-cubic-yard Erie air shovel to load several five-cubic-yard Ford dump trucks which hauled the rock to the bunkers. No.5 and No.3 gyratory crushers reduced the aggregate before screening and hauling to roadway fill sites.

Widening the subgrade between Stations 0+00 and 311+00 from the 16' width completed in 1925 to an 18' width proved the most time-consuming and labor-intensive task, as all fill had to be hauled eight miles from the Reed Quarry. Vallandingham used thirty mules and other "necessary equipment" to accomplish nearly all excavation, and presumably struck a better balance between cuts and fills beyond Station 311+00. Butler spreaders distributed the base and top courses while an NPS steam roller and two 10-ton cylinder-type gasoline rollers achieved excellent compaction between courses. After rolling, another 25-30 percent of "fines" filled the voids. In the 1927 season, workmen with shovels spread the fines; in the 1928 season, a Combs spreader completed the job more efficiently. CMP culverts were placed well in advance of grading operations.

Gilmore Oil Company supplied asphaltic oil for the penetration macadam surface, and when Vallandingham's makeshift spreader failed after a 1/2-hour run, also supplied a retort for heating the oil and a distributor for spreading it. The 10-ton rollers compacted the macadam. In December 1928, the contractor finished an 18'-wide 1926 forest highway standard road with minimum 200'-radius open curves, 300'-radius blind curves, and 6 percent maximum grades. The park superintendent, landscape engineer, and BPR district engineer all accepted this first segment of East Rim Drive in December 1928, but were unhappy with the outcome since additional funds had not been found and the new roadway ended three miles short of Grandview. They were anxious to complete the road to that point and beyond to Desert View.[21]

Congress approved a one-mile extension of Grand Canyon National Park's southern boundary during winter 1926-27, enabling the BPR to complete a survey of an alignment which would remain within park boundaries and NPS forces to clear and grub the roadway between Stations 509+00 and 1305+03 (Desert View) by spring 1927. In April 1927, the BPR advertised this second segment of East Rim Drive. In May, USDI awarded the contract to Pearson & Dickerson of Los Angeles, California, for the low bid of $133,000.00 In July, the contractor moved onto the site, established a base camp at Grandview, and began work. Aside from a winter shutdown from 16 December 1927 through 19 April 1928, the contractor worked

steadily through project completion on 10 October 1928. Tillotson and Park Engineer Carrel forwarded their acceptance on 25 October 1928.[22]

Pearson & Dickerson's contract included only two miles of surfacing, but as the project progressed and the NPS seemed to have difficulty allocating funds, even this surfacing was deleted from the project. The contract price for more than thirteen miles of roadway suggests that the principal objective was to grade and provide for drainage and little else. Excavation alone amounted to 72 percent of the work and the resultant roadway, as noted later, would not stand up to winter nor wet weather travel. The contractor apparently had little difficulty meeting his commitments, but delays and more than $25,000.00 in extra costs resulted from the "Buggeln alternate" alignment from Station 736 through 834. The county was responsible for construction of Stations 798+83 through 809+60, but may well have hired the on-site contractor to complete the work.[23]

During summer 1928, BPR engineers, Superintendent Tillotson, Horace Albright, and Fred Harvey officials expressed anxiety for getting East Rim Drive beyond Station 509+00 ready for winter use. A third contract was sent out to bid 23 June 1928 for the placing of a crushed-rock bottom course and an oil-treated crushed-rock top course, which further indicates that the Pearson contract was little more than a grading project. USDI rejected the two bids received. As summer waned, Tillotson suggested force account funds and NPS labor to complete subgrading from Stations 509+00 through 590+00 while holding off bids for surfacing and oiling until spring 1929.[24]

As the roadway approached Station 590+00 near Grandview, it dawned on Superintendent Tillotson that construction of a spur to the point itself (0.8 mile) had not made it into the contract with Pearson & Dickerson. A "narrow, crooked" road did exist out to the point, but was impassable when wet. The line which BPR surveyors had plotted to the point had been thwarted by a fence thrown up by workers of the Canyon Copper Company which owned an old mill site at the end of the point. Tillotson while still park engineer had surveyed a new line along park property, and now requested another $10,000.00 and park forces to build the spur. His argument made sense: why have a ten-mile-long paved road and "still be approximately 8/10 of a mile from any objective?" Albright agreed and authorized $12,000.00 to complete the main road to Station 590 and $10,000.00 to complete the Grandview spur, all work to be done by park forces under BPR supervision.[25]

Problems preparing an all-weather road as far as Grandview Point continued into the 1929 travel season, and all seemed to revolve

around the park's inability to program sufficient money to get a satisfactory surface atop the roadway. Highway engineer W.R.F. Wallace noted during the summer monsoon season of 1929 that

> on the afternoon of July 31st we had the first heavy rain of the summer on this road, and as a result all the Harvey Busses, as well as all other cars were stuck in the ditches at various places along the road.... all the adobe and red clay stretches were so slick traffic couldn't stay on the road.[26]

Wallace proposed that a material composed of soft sandstone with high lime content be placed over the several adobe and clay sections. He predicted it would not have the wearing qualities of the heavier conglomerate placed in other segments, but would be cheaper and would shed and absorb water as well or better. The bad segments were along the Yaki and Yavapai spurs and the main roadway between Stations 509+00 and 590+00. Wallace estimated the cost of this work in 1929, including subgrade and shoulder work, at $48,000.00-52,000.00.[27] Correspondence suggests that park forces completed this temporary surfacing before winter to keep the "all weather" road open.

In July 1930, USDI awarded a contract to Lord & Bishop of Sacramento, California, to place a plant-mixed, oil-treated crushed-rock surface of one 4" course on most of East Rim Drive and associated spurs. The 18.46-mile project included 20'-wide surfacing on Sections 1-A3 (Station 501+79 to 655+00), 1-B (Station 655+00 to 1300+45), and 1-F (Grandview spur); and 18'-wide surfacing on 1-C (Yaki spur), and 1-D (Yavapai spur). The value of the contract was $114,000.00. The contractor began this project in August 1930, shut down for the winter, resumed in April 1931, and finished in June 1931. The remainder of East Rim Drive from Station 0+00 through 501+79 held up well with its 1928 macadam surface. In 1938, this initial segment would receive its first bituminous-treated plant-mixed aggregate surface, applied directly over the asphaltic-bound macadam.[28]

In September 1931, USDI awarded a contract to Heitsch & Bitton of Winslow, Arizona, to place an asphaltic seal coat on the crushed rock surfacing applied the year before. The 18.993-mile project included a 20'-wide application on Sections 1-A3, B, and F; an 18'-wide application on Sections C and D; and a 16'-wide application on Section G (Moran Point spur, graded in 1930 by NPS forces). The value of the contract was $8,750.00. The NPS supplied the asphaltic oil free of cost in tank cars at the Grand Canyon RR depot and identified a satisfactory gravel pit about 1/2 mile east of Station 385+00 on the South Approach Road.[29] As a matter of record, specifications for this first chip seal coat on East Rim Drive (and perhaps the first on any park road) read:

> Screenings shall be crushed from sound, tough, durable rock or gravel, free from adobe, vegetable matter, loam or other deleterious matter. It shall be free from thin or elongated pieces and shall be of such a size that all will pass a 3/8" sieve and not over 20 percent will pass a ten mesh sieve.... The oil shall be heated to a temperature of not less than 300 degrees F. nor more than 400 degrees F. and spread at the rate of about 1/5 to 1/4 gallon per square yard....Immediately following the application of the oil, the stone screenings, shall be spread at the rate of approximately fifteen to twenty pounds per square yard of surface covered.... Immediately following the spreading of the screenings the surface shall be broomed to secure a uniform spreading of the screenings and the fuel oil.[30]

The NPS-supplied oil contained at least 94 percent asphalt of "a penetration of 80," at a temperature of 77 degrees. Quantities estimated for this project totalled 230 tons of asphaltic oil and 1600 cubic yards of screenings.

Although sources indicate a satisfactory job by Heitsch & Bitton, USDI unaccountably awarded a contract to Jack Casson in June 1932 to apply another seal coat over the exact same mileage completed in 1931. Casson, who undertook several park surfacing projects in the 1920s and 1930s, made use of materials left by the former contractor, including 600 cubic yards of crushed screenings stockpiled at a quarry site two miles south of Station 854, and two carloads of asphaltic oil stored in a coil-heated earthen sump at the same site (later buried). Casson completed this project in September 1932.[31]

The project to construct an automotive road from Grand Canyon Village to Desert View which began with initial debates and locations in late 1923 can be said to have been completed when a satisfactory surface was obtained in 1931. The main roadway measured: Section 1-A1, 5.942 miles; 1-A2, 3.614 miles; 1-A3, 2.902 miles; and 1-B, 12.396 miles for a total length of 24.854 miles, Station 0+00 through 1300+45. Scenic spurs in place by this year included Yavapai spur, 1.255 miles; Yaki spur, 1.214 miles; Grandview spur, 0.836 miles; and Moran Point spur, .390 miles for a total length of 3.695 miles.

Major Repairs and Alterations

Although complete from a project viewpoint, East Rim Drive and its scenic spurs as constructed by 1931 did not follow ideal alignments, did not go anywhere from Desert View, and lacked many aesthetic features constructed later such as masonry retaining

walls, parapets, curbing, and culvert headwalls. Grand Canyon Route #10 would continue the road to the east boundary within a few years, and much of the finishing work and landscape touches would be done in the 1930s by the CCC, the first contingents of which arrived at GCNP in May 1933 just months after Jack Casson completed the road's second seal coat. Later in the 1950s and 1960s, after the NPS at long last obtained Buggeln's property and traffic volume demanded new alignments, large portions of the road and spurs would be reconstructed.

One of the first projects completed after initial road construction, which filled out the modern complement of scenic spurs, was the grading of the Lipan Point spur road in October 1932. NPS forces spent a little more than $5,000,00 to construct the 20'-wide, 2306'-long road to the top of Lipan Point. Plans called for surfacing of this roadway the following year.[32]

Another major project which completed the modern length of East Rim Drive entailed construction of Grand Canyon Route #10. This roadway segment of approximately three and one-half miles from Desert View to the east park boundary had not occurred to anyone until plans for an approach road from Cameron began to unfold in the late 1920s. Until then, Fred Harvey customers who wished to travel to Cameron and Tuba City were carried in concessioner buses from the end of the road to Grandview by way of the Navahopi Road, which ran south of East Rim Drive roughly along the lines of today's Forest Road 307. The East Rim Drive project included a short spur which left the main roadway about four miles west of Desert View near Moran Point to connect with the Navahopi Road. This had the effect of making the road to Desert View a four-mile-long spur, and when the need for a new approach to replace the Navahopi Road became apparent, it only made sense to continue the automotive road from Desert View.

In summer 1929, BPR engineer C.G. Morrison made a route study of a new approach road from Cameron and recommended a route through Tusayan National Forest with a connection to East Rim Drive some nine miles west of Desert View near Grandview. In August 1930, however, Superintendent Tillotson, BPR Engineers W.R.F. Wallace and J.H. Brannan, and Arizona Highway Department Engineer Percy Jones completed a reconnaissance of the approach road, including the route of Grand Canyon Route #10, and determined that it should pass through Desert View. They proposed an alignment that would leave the old Navahopi Road about a mile east of Rowes Ranch, cross Lee Canyon, and continue north via Walton Tank to Desert View. Ultimately, this latter route was chosen because it offered more road miles within the park, would require three less miles than Morrison's route, would be cheaper to construct, and would allow visitors to make use of the many facilities planned

for the Desert View area.[33] Engineer Wallace described the route:

> After leaving the [Desert View] loop the line will follow out a wide flat ridge or mesa until it reaches a narrow ridge between two draws or canyons. There is an easy descent down this ridge with very good alignment. Just before the park boundary is reached a short drop on a 5 or 6 percent grade will be necessary to get off the ridge onto the open flat.

Construction would eventually follow a 3.47-mile alignment along this route.

It is interesting to note that a routine title search of county records for the land to be traversed revealed that the Santa Fe-Pacific Railroad held title to Section 35, T.31 N., R.5E and Section 1, T.30 N., R.5E within the park. The Atlantic & Pacific Railroad had been granted odd-numbered sections for a distance of 40 miles north and south of their thirty-fifth parallel trackage (by the charter of 1866), and when some of these reverted to the government because of mineral claims, the railroad was given option to choose in lieu lands along a ten-mile-wide "indemnity strip," within which fell the questioned sections. The discovery caused only a few weeks of anguish, however, as Acting Associate Director Demaray determined that the railroad's claims to the two sections in 1887 had been rejected by the General Land Office because they had been unsurveyed in that year. Clerical errors since 1887 had perpetuated the mistaken title records.[34]

The actual survey for Grand Canyon Route #10 (and the rest of the approach road, of which Route #10 was considered a part) was completed 16 December 1930 by Engineer Brannan, Chief of Party L. Krichesky, and a crew of ten men. Landscape architect Thomas Carpenter and Engineer Wallace walked the roadway and made some changes, most notably taking the initial 3300' tangent planned from Station 3+38 (at Desert View) and revising it into two long, flat curves with a short tangent in the middle. They also had some suggestions for the steep grades and sharp curves planned between Stations 152+00 and 160+00. Their comments resulted in design modifications by the BPR, beginning at Station 0+00 with a 250'-radius curve compounding to a 1000'-radius curve, then a short tangent followed by a 1300'-radius curve, as well as a new line from Station 135+00 to 170+00. Another suggestion of landscape architects to decrease cuts and fills by replacing minor grades with a line which followed the topography was subsequently adopted.[35]

The BPR completed specifications for grading Route #10 (Station 0+00 to 184+36) and Section A (Station 652+29 to 838+30) of the

approach road and put the project out to bid in November 1931. Of the seventeen bidders, USDI awarded the contract to Everly and Allison of Albuquerque, New Mexico, for the bid of $145,000.00. The contractor began work in December 1931, although he finished little of Route #10 until resuming operations in April 1932.[36]

Grading of Route #10 in April through August 1932 consisted of clearing, grubbing, and burning along the roadway; considerable blasting; and difficult shovel and Caterpillar work to balance required cuts and fills. Excavation soon exceeded that estimated for the project as the contractor had to bring a team of six jackhammer men, powder man, helper, and blacksmith to do nothing but blast their way down the Coconino Plateau. The Cat 60 and 1/2-yard shovel trailed after them, hauling off detritus and boulders to the nearest fill sites. The contractor had nearly completed the grading of an 18'-wide 1929 forest highway standard roadway by October 1932.[37]

With the grading of Route #10 and sufficient progress made along other segments of the Cameron approach road by early summer 1933, Grand Canyon National Park administrators achieved what they had envisioned since the middle 1920s--a second entrance road to the south rim. In June 1933 park forces completed a checking station for the new entrance with funds obtained from one of the first allotments of the depression-era Public Works Administration. Because geologic and vegetative cover near Desert view consisted principally of limestone, low shrubs, and juniper, NPS landscape architects designed this structure different from those along the North and South entrance roads, which were essentially log cabins within the ponderosa forest. The east entrance station exhibited a compromise between the natural landscape, represented in the rubble masonry walls, and the architectural style of other south rim structures with its gable roof and rough-sawed roof rafters, brackets, and window trim. The approximate 10' x 10' building had a door on the north side and windows on the east and west.[38] Rangers stationed here began collecting the $1.00 entrance fee (initiated at the south entrance in 1926-27) from the increasing number of tourists approaching from the east even before the approach road had been surfaced.

Subgrade reinforcement of Route #10 was scheduled for spring 1933. O.F. Fisher of Phoenix, Arizona, submitted a low bid of $6,500.00 for this work in April 1933, but President Roosevelt impounded all road funds in early 1933 until details could be worked out for public works projects, thus, USDI rejected all bids. The BPR re-advertised the subgrade project in October 1933 with funding authorized under the Recovery Act, but added work on Sections A, B, and C of the approach road to the project. USDI awarded the contract to Skousen Brothers of Albuquerque, New Mexico, in November 1933, for the low bid of $42,000.[39]

Skousen recruited PWA men from Flagstaff to begin work in December, but did not start on the Route #10 portion until late February 1934 when he moved his camp to the borrow pit opposite Station 165+00. Going to three 7-hour shifts he was able to move 1,000 cubic yards of subgrade material on some days, spreading it along the roadway in a layer 0'-9" deep. Occasional light snowfall helped the contractor compact the gravel materials. He completed the project by the middle of April 1934.[40]

While Skousen Brothers completed subgrade reinforcement, the BPR advertised for a 2-1/2" bituminous-treated, crushed-rock surface for East Rim Drive's Lipan Point spur, Route #10, and Sections A, B, and C of the approach road. USDI awarded the contract to New Mexico Construction Company of Albuquerque, New Mexico, in May 1934 for the low bid of $125,000.00 and work began the following month. The contractor completed this project in November 1934, resulting in a 3.536-mile-long, 18'-wide surfaced roadway with 7' lanes from Desert View to the park's east boundary (and beyond toward Cameron).[41]

Following completion of the Lipan Point spur and Grand Canyon Route #10, Superintendent Tillotson and the BPR redirected their attention to other road projects underway within the park, especially completion of the Cameron approach road and planning for a new West Rim Drive. Improvements to existing roads, including East Rim Drive, fell into the capable hands of NPS landscape engineers and public works forces. One of the first assignments given these men when they arrived in May 1933 was a several years-long general project to improve the South Entrance Road and "Desert View Drive" (another of East Rim Drive's many historic names). Tasks within this project included widening shoulders, rounding slope banks, clearing ditches, building or reconstructing headwalls and retaining walls, sealing cracks, patching potholes, roadside cleanup, repair of guardrails, and revegetation. As Minor Tillotson put it:

> From a purely mercenary point of view the park is in a fair way to gain more in the form of physical improvements by the National Recovery Act than would have transpired for a number of years--in some instances perhaps not at all--under a normal trend of park affairs.

The superintendent foresaw the potential benefits to his park road system with nearly unlimited manpower and a government anxious to allocate dollars to keep unemployed men busy when he made this statement in September 1933.[42]

One of the early projects completed by CCC crews in 1933-34 entailed construction of a footpath and improvements to the

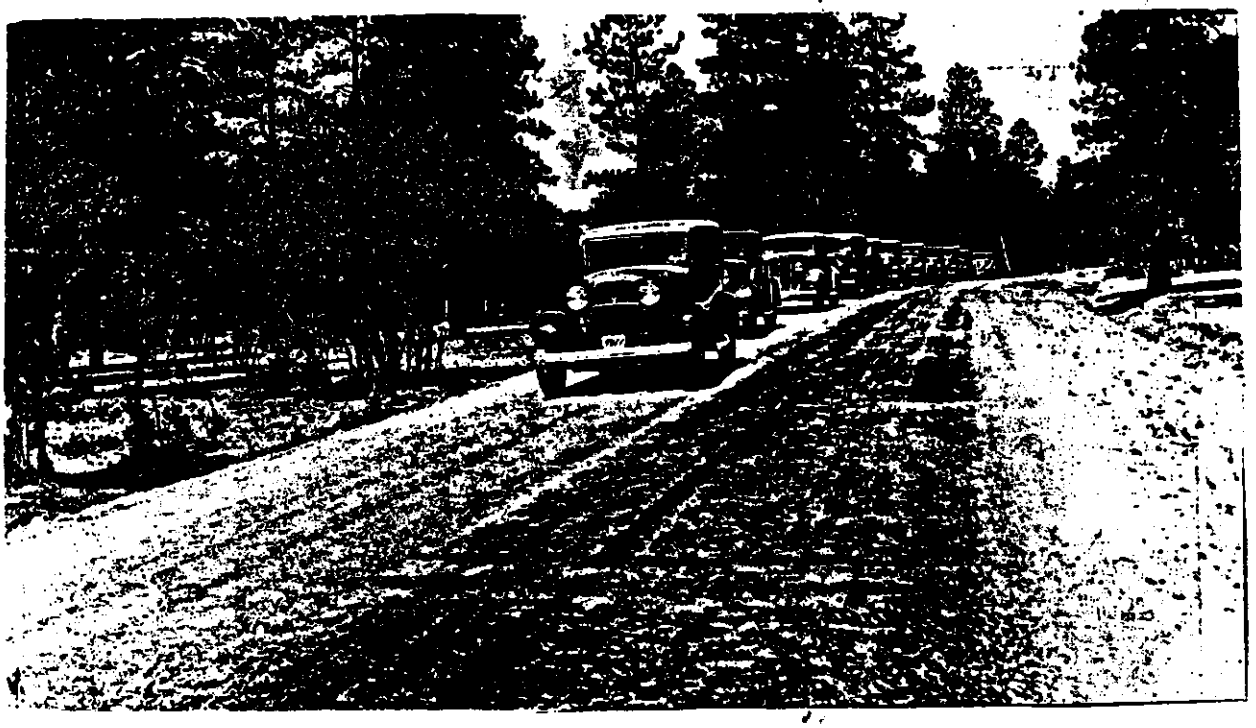


Figure 9. First auto caravan of the 1934 travel season, near Grandview. (GRCA Image #2892, GCSC)



Figure 10. CCC crews constructing whole-log guardrails along East Rim Drive near Grapevine Hill, 1938. (GRCA Image #6115, GCSC)



Figure 11. Park crews grading, clearing ditches, and rounding embankments along the Lipan Point spur, ca. 1932. (GRCA Image #2927, GCSC)



Figure 12. CCC crews obliterating an old alignment along East Rim Drive, March 1937. (GRCA Image #9290, GCSC)



Figure 13. CCC crews expanding parking area at Yaki Point, November 1937. (GRCA Image #3954, GCSC)



Figure 14. CCC crews (park trucks) constructing walls at Desert View, September 1937. (GRCA Image #335, GCSC)

parking area and campground at Desert View. The campground along the rim, established in 1928 following completion of the road, had become quite popular once the Cameron approach road and Route #10 were completed. Within this project, crews constructed a 4'-wide gravel footpath with stone borders from Mary Jane Colter's Watchtower east for 905 feet along the rim and the north side of the campground. They also created a 50-car parking lot within the loop road fronting the tower by preparing an 18"- deep graded fill strip 20' wide and 490' long. This entire project which required 200 man days cost the park service $719.68.[43]

One project completed by CCC crews in their later years at GCNP (late 1930s) included replacement or installation of guard rails along East Rim Drive. Under Park Project #560, Minor Roads & Trails, and #701-132, Guard Rails (Construction), men placed both masonry and log guardrails at several points during 1937. The 400'-long masonry wall which went up at "Scenic View" near Desert View was completed by paid workmen, perhaps PWA men recruited from Flagstaff. CCC men were responsible for the post and whole log guardrails, however, which totalled 912 linear feet beside the roadway below and along Buggeln Hill and Grapevine Hill. Log guardrails were built slightly lower to the ground than the post, block, and W-beam structures seen today, and featured large reflectors affixed to log rails at both ends.[44]

In relation to the guardrail project outlined above, it is worth noting that the park still favored wooden, rustic-style signs and guardrails during the 1930s, but some felt that these structures should be built with metallic components favored by western states' departments of transportation. By 1937, the park had some guard rails which had been constructed of wooden posts and metallic rails, and Superintendent Tillotson favored this design for its durability, lower cost, and low maintenance requirements. Although the park chose to go with all wooden guardrails for the project above, the added work of going to the forest service to cut trees for the project, then peeling, air-drying, and creosote-treating the logs to resist rot and insect infestation portended an end to this type of structure (as it did for wooden roadway signs which required similar preparation).[45] By the late 1940s, GCNP adopted Arizona Department of Transportation standard W-beam guardrails of "weathering steel" (which rusted to a rustic brown color) supported by wooden posts and blocks, as well as metallic roadway signs.

Aside from minor projects such as guardrail construction, CCC crews addressed one of the more important features of Grand Canyon's scenic highways--finishing pullouts and parking loops begun by the several highway contractors. James Vallandingham, Pearson & Dickerson, and later contractors had for the most part graded and surfaced the scenic loops and spurs which led to them.

Their tasks included construction of some masonry (dry rubble) walls as well, but the CCC came through in the 1930s to finish the work and in some cases reconstruct these walls.

One example of this reconstruction completed under Park Project #676 entailed construction of the first parking pullout east of the South Entrance Road in 1937. James Vallandingham in 1927-28 had constructed the dry rubble masonry wall along the rim at this point, but by 1937 it was crumbling into the Canyon. CCC crews constructed a 20-car, crushed gravel (buckhead, actually) parking pullout and reconstructed the wall, exercising special care to preserve juniper and pinon trees astride the parking area. Costs for this entire project, which required 425 man days, totalled $284.54, a price tag which might make today's maintenance folks sigh with envy.[46] Photographs and completion reports indicate that CCC crews routinely reconstructed original contractor walls all along East Rim Drive as at this pullout, but it is uncertain if all walls seen today along the loops, spurs, and main roadway can be attributed to the CCC.

CCC crews also surfaced a number of the scenic loops and parking areas, using park NPS rock crushers and other equipment to complete the tasks efficiently and cheaply. One of their primary work sites was at the intermittent CCC camp at Desert View, the terminus of the original drive where Mary Jane Colter built her imposing Watchtower in 1932 and the NPS envisioned major tourist developments. Under Park Project #648, CCC men put in 254 man days to place a crushed-rock surface at the Desert View parking Loop (and another parking area in the village) in summer 1937 for a total cost of $5.42.[47] They also constructed a footpath and masonry wall near the Watchtower in 1937 and were continuously involved with other site improvements such as rebuilding shoulders, rounding slopes, and revegetation.[48]

Completion and improvements to East Rim Drive quickly made the scenic roadway the most popular and well-travelled byway within the park. Its popularity and mounting use through the 1930s was due to a number of factors. Foremost were major improvements to regional roads east of the park, including U.S. 89, U.S. 66, and Arizona Highway 64 of which East Rim Drive was a part. All realigned, constructed to modern highway standards, and surfaced by the late 1930s, these roads formed a natural loop which prompted some tourists to bypass Grand Canyon Village entirely. Too, East Rim Drive was the longest scenic roadway in the park, offering some of its grander views at Lipan Point and Desert View. Further evidence of this popularity is seen in the daily, ranger-led automobile caravans which ran throughout the 1930s, as frequently as three times per day, averaging 28 vehicles per caravan (63 vehicles appears to be the record).[49]

Aside from its popularity as a scenic roadway, East Rim Drive gained increasing usage as an entrance road to facilities at Grand Canyon Village. While most transcontinental motorists in the Southwest travelled U.S. 66 and visited Grand Canyon via the South Entrance Road during the 1930s, a growing number of regional tourists visited the southern Utah parks at Zion, Bryce, and Cedar Breaks. Many of these toured the north rim of Grand Canyon, then drove around the east side via U.S. 89 and visited the south rim via the Cameron approach road and East Rim Drive. Entrance to the park along this latter route in 1938 increased threefold from the previous year, and in 1940 totalled 100,000 (of approximately 370,000 park visitors). In 1939, Superintendent H.C. Bryant reported that travel along the road and visitation at Desert View was greater "than ever before," and that "development of Desert View is the most important single future problem that has appeared during the year." In 1939, as a first response to heavier use at Desert View, the Fred Harvey Company built a one-pump gasoline and service station and the NPS expanded its campground.[50]

Increased usage of East Rim Drive by 1939 also prompted in-depth discussions among NPS and BPR engineers concerning reconstruction of the roadway. Contractor Jack Casson completed a bituminous-treated, plant mix aggregate surfacing project from Station 0+00 through 509+00 over the original 1927-28 macadam surface in August 1938, thus, most changes discussed in 1939-40 concerned the remainder of the roadway which, with the heavy traffic of the 1930s, would soon have to be resurfaced.[51] Although the war years would scale down reconstruction plans, discussions of 1939-40 pointed out perceived inadequacies in the roadway only twelve years following original construction.

BPR Associate Highway Engineer W.J. Ward completed a preliminary study of the roadway's inadequacies in June 1939. He began his report with the foreword that East Rim Drive "carries much more traffic than any other road in the park," and that traffic entering the park from the east equalled that arriving along the South Entrance Road (this may have been a slight exaggeration). Ward believed that excessive "curvature" was the main problem with the road. For example, Stations 300+00 - 385+00 contained several curves as sharp as 30 degrees and Stations 730+00 - 822+00 (the Buggeln alignment) contained 2,300 linear feet of 8 percent grade, a 16-degree blind curve, and two 10-degree curves. He gave as further examples of poor alignment sections between Stations 1005+00 - 1030+00, 1060+00 - 1090+00, 1165+00 - 1200+00 (near Lipan Point), and 1231+00 - 1260+00. Summarily, Ward felt six miles--fully 25 percent--of the road should be realigned to eliminate nearly all severe curves and obtain a safe travelling speed of 40 mph.[52]

BPR Senior Highway Engineer G. L. McLane, like all parties concerned with the road since 1925, thought the Buggeln alignment the worst section of the road. He reiterated Ward's figures and, added that the foot of Buggeln Hill contained a 96-degree, 286'-radius curve. The road, too, passed through a ravine (south of today's alignment) and if it could be brought through the Buggeln property would provide two more scenic views. Such an alignment, roughly that first surveyed in 1925, would be about 1,300 feet shorter than the existing roadway with minimum radius curves of 1,000 feet and maximum grades of 6 percent. McLane had reason to hope that a new alignment might be had, since the tough old German immigrant had died in November 1939 and Mrs. Buggeln seemed amenable to a right of way or sale of the property.[53]

In March 1940, BPR engineers Wallace and Ward, GCNP engineer Carrel, landscape architect Kuehl, and regional director Tolson covered proposed line changes on the ground. These included changes to alignment at Stations 300+00 - 306+00 (Duck-On-The-Rock); Stations 490+00 - 510+00 (Grapevine Canyon); Stations 736+00 - 822+00 (Buggeln alignment); Stations 1005+00 - 1035+00; and Stations 1063+00 - 1093+00 near the old ranger station where the 0.87-mile spur once left East Rim Drive to join the Navahopi Road. During this inspection, "considerable discussion" arose whether it was the park's intent to make "speedways out of the Park roads" by streamlining the alignment. Someone, probably engineer Carrel, remarked that this was definitely undesirable, but park visitors often exceeded the 35 mph limit on park roads where scenic views were spaced too far apart.[54]

With all the engineers wanted to accomplish, Acting NPS Director Demaray reminded them that only $230,000.00 was available for the project, and that the intent was basically to widen and resurface the roadway. Landscape architect Kuehl reviewed the survey which followed in August 1940. He reported that the project would include realignment from Stations 298+00 - 307+00 (Duck-On-The-Rock) to eliminate the hazardous parking situation at the rim. This would bring the alignment south through the existing parking area, and relocate parking along the rim so pedestrians did not have to cross the highway. Other changes would take in Stations 486+00 - 510+00 (Grapevine Hill) to correct the sharp curvature, and Stations 629+00 - 638+00 ("Hearst Property") to eliminate the existing broken back curves with a 1500'-radius curve and a 700'-radius curve.

Other survey proposals included Stations 1008+00 - 1035+00 where new alignment would replace two "gooseneck" curves and a third hazardous stretch with one sweeping curve; Stations 1068+00 - 1088+00 to eliminate the 28-degree blind curve at the old Desert View Ranger Station; and Stations 1162+00 - 1181+00 to replace a blind gooseneck curve with an "S" curve of 1600' radius and 2800'

radius. The latter change would also require extension of the Lipan Point spur to meet with the new line. The roadway at Stations 1214+00 - 1237+00 would be relocated away from the rim and the existing segment which passed a scenic viewpoint would become part of the approach to a parking loop. The final change would be at Stations 1287+00 - 1297+00 to replace two 200'-radius broken back curves with a 350'-radius curve and additional parking for the Desert View Watchtower.

Specifications developed after the 1940 survey included a 26'-wide roadway with 22' of pavement and 2' shoulders; paved gutters on all sections of 3 percent or greater grades; topsoil for all fill slopes; designation of borrow pits at 4,000' intervals from Station 305+00 to 1070+00; pipe arch culverts with masonry headwalls--the rock to be obtained from Grapevine Canyon, 1,000 feet south of Station 800+00; drop inlets within paved gutters; minimal timber clearing; and obliteration of existing roads where visible from new alignments, including removal of surfacing and grading to restore natural contours. The survey also envisioned a new alignment for the Lipan Point spur and modifications to the parking areas at Duck-On-The-Rock and Desert View as previously identified. Changes to the Buggeln alignment were not included in this survey because negotiations with Mrs. Buggeln had not yet borne fruit.[55]

Exactly how much of this work was completed in the following two years is unknown. After reviewing the survey, Superintendent F.A. Kittredge remarked that available funds would not cover half the proposed work and suggested a project restricted to widening and surfacing as had Assistant Director Demaray. BPR engineer McLane did not argue, but responded that realignments as noted above would cost very little more than widening and surfacing the existing road, and would shorten the roadway by nearly a mile. Kittredge did not appear convinced, and when the two met in December 1940 to revisit the entire project, estimates totalled $393,000.00[56]

Superintendent Kittredge in his Fiscal Year 1940 annual report mentioned that East Rim Drive from Grapevine Canyon to Desert View would be "rebuilt" in the coming year, implying a major project in the works. In the following year, Superintendent H.C. Bryant commented that construction on the project began in August 1941, shut down for the winter, then resumed in April. By June 1942 "most of the old road had been torn up and the parking area at Desert View was about 60% complete." He later noted that the 17-mile project was completed by 30 September 1942, with the exception of a flush seal coat, and that rustic design road signs replaced antiquated enamel signs along the drive. There are some indications that public works and NPS crews completed this entire

project, which would have reduced costs dramatically and allowed more work to be accomplished.[57]

The 1939-42 East Rim Drive project may be considered the end of the great road building era at Grand Canyon National Park. Aside from the facts that all major roads within the park had been completed to modern standards, and that Superintendent Bryant favored interpretive activities over building projects, the war called a halt to major park improvements. On the dark side, rangers went off to war and road allocations dwindled; on the bright side, roads were fairly new and fewer visitors arrived to wear them down (or note their deficiencies). Fewer visitors, gasoline rationing, and rubber rationing put an end to scenic bus tours and automobile caravans along the scenic drives. The Desert View (and North Rim) checking stations closed. Road crews went into a strictly demand maintenance mode for the duration.[58]

As the war drew to an end, park administrators began making plans for construction in the postwar years. Plans included rebuilding parking facilities at Yaki, Grandview, Moran, and Lipan points, and realignment through the Buggeln properties--a purchase option for which the NPS obtained from Mrs. Buggeln in July 1942.[59] Postwar allocations did not allow for the work, however, even though returning visitors and their automobiles soon inundated the park. Harold Bryant summed it up nicely when he reported in July 1946 that

> Until V-J Day, travel was relatively light, although showing a slight increase over 1945 fiscal year. However, with the end of the war, it appeared that everyone who had a trip planned and interrupted by the war immediately resumed his plans, in many instances starting the same day. He was joined by thousands of others who were simply enjoying the relief from war tensions.[60]

By 1947, East Rim Drive began to exhibit the wear of increased visitors and a 5-year hiatus from preventive maintenance. Pavement edges had begun to ravel, requiring park crews to reblade unlined ditches to pull in and reinforce the surfaced roadway. The NPS responded with the acquisition of war surplus maintenance equipment and additional personnel to keep after the roads, but continued to be hampered by the new 40-hour work week, insufficient funds, and personnel ceiling limits. Meanwhile, the number of visitors crept over half a million per year (611,000 in 1946-47 travel year), almost all of whom came by automobile and an increasing number by heavy buses, motorhomes, and travel trailers.[61] Administrators had to question the adequacy of East Rim Drive (and all park roads), not only in a maintenance sense,



Figure 15-16. Above: Damage to East Rim Drive by a summer storm, July 1946. (GRCA Image #1304) Below: East Rim Drive pavement failures, 1940. (GRCA Image #2936)



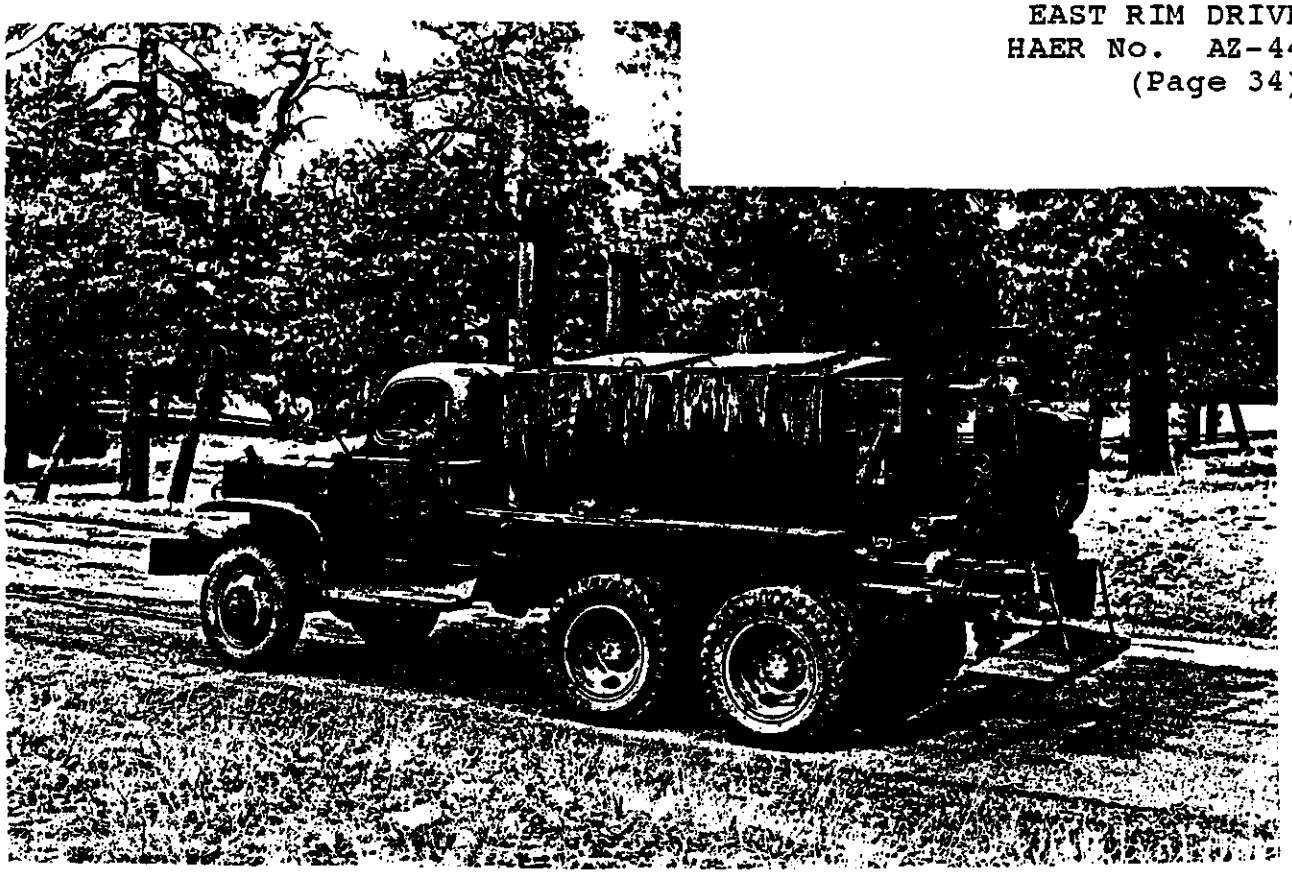


Figure 17. Miles T. Rowan driving the park's oiler truck during a chip seal job to East Rim Drive, October 1948. (GRCA Image #1591)

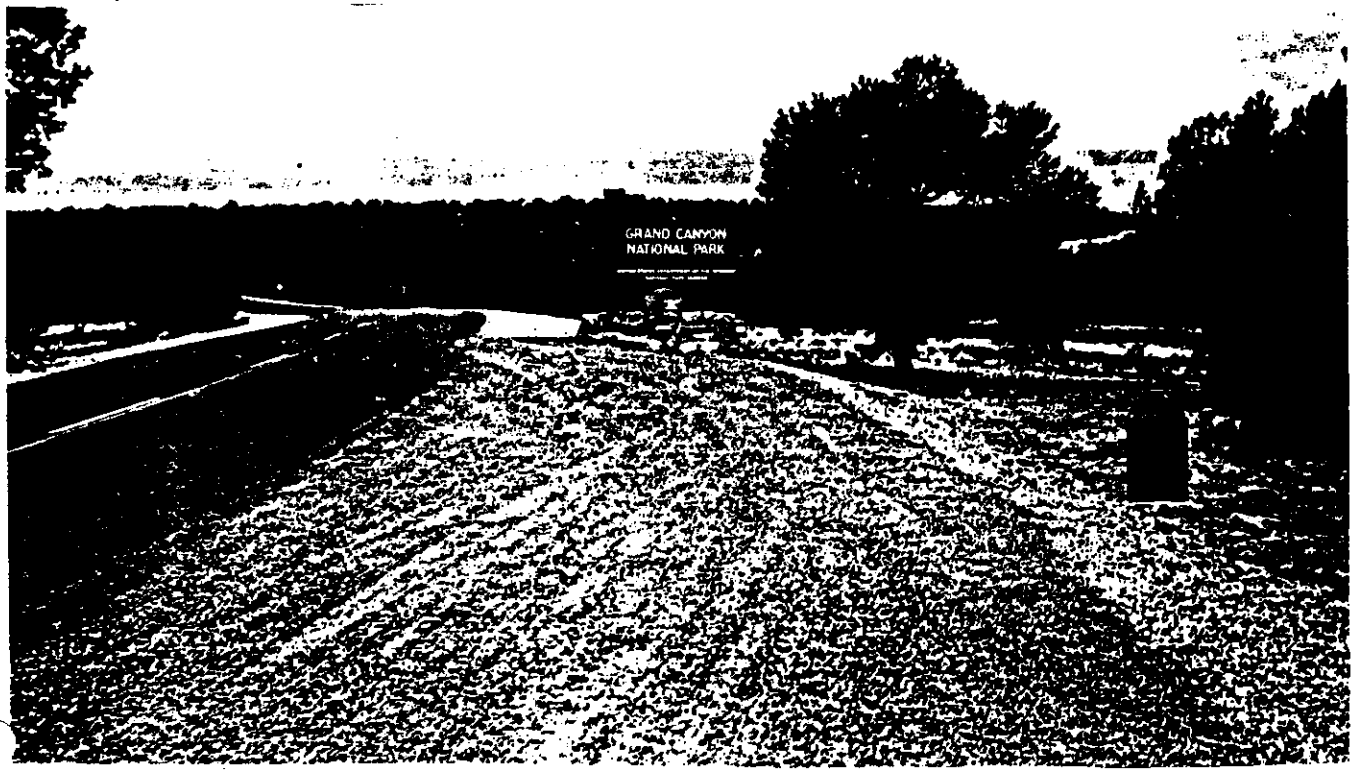


Figure 18. East Entrance sign at park boundary, 1963. (GRCA Image #4525E, GCSC)

but in relation to traffic patterns, weight limitations, and speed limits.

While planners mulled over future road needs, maintenance crews kept after the roads and held their own. Funds for maintenance began to increase in the late 1940s, and park crews were able to continue with patching and shoulder work along East Rim Drive. This work was extended to the eastern end of the road (Route #10) in 1951 when 3,200 cubic yards of dirt and rock were moved from borrow pits to widen and improve shoulders.[62]

When funds became more generally available for infrastructural improvements in the early 1950s, GCNP administrators undertook a program of redesigning and reconstructing roads to the needs and standards of the decade. The first project completed was that of realigning South Entrance Road. Completed in 1954, this new road obviated the western end of East Rim Drive by approaching the south rim at Mather Point and continuing into Grand Canyon Village along a more desirable line constructed to modern standards. In 1955, park administrators turned their attention to the remainder of East Rim Drive, running east from its intersection with the new South Entrance Road.

In July 1954, Superintendent Preston P. Patraw met with NPS Landscape Architect C.I. Carter and BPR engineers B.M. French, G.E. Nelson, and E.E. Erhart to review requirements for reconstruction of East Rim Drive. Patraw expressed concern for the road's alignment in the context of increasing traffic, noting that it served as an important entrance road as well as a scenic drive. Carter emphasized the need for more viewpoints. All agreed that determination of an appropriate alignment would be aided by aerial photography of the entire route. Thereafter, during summer 1954, the park contracted with the photogrammetic engineering firm, Jack Ammann Company of San Antonio, Texas, to produce aerial photographs (scale 1" = 800'). These prints were reviewed in September, and the men identified above covered a proposed route on the ground in October 1954.[63]

Engineer Erhart completed a reconnaissance for relocation of East Rim Drive in January 1955. Erhart identified three possible locations based on whether priority be given to higher standards, safety, and vehicle speed (Patraw's concerns); developing a greater number of scenic views (Carter's desire); or compromise between the two objectives. Whichever plan was chosen, Erhart recommended a 30'-wide roadway with 12' traffic lanes, maximum grades of 7 percent, and minimum radius curves of 1000' with 0.08' per foot maximum superelevation. These specifications would conform to the standards used on the new South Entrance Road.[64]

During 13-15 April 1955, Erhart, French, Patraw, and others completed a second reconnaissance of the proposed alternate alignments and came to some basic agreements. Generally, the current alignment would be followed but improved by flattening curves, widening the roadway, and improving grades. Widening would be accomplished on only one side of the roadway to preserve the landscape of the other side. Five major interpretive stops would be established at Duck-On-The-Rock, Grandview Point, Moran Point, Lipan Point, and Desert View, and ten "intermediate rim contacts" provided without deliberate circuitous alignments. In addition, parking facilities would be improved at all major stops and at picnic area sites, which were to be spaced approximately at four-mile intervals. Three existing picnic areas at Stations 160+50, 208+50, and 410+50 would be retained and improved.[65]

The second reconnaissance also identified line changes for the entire project. Major realignments included the Yaki Point spur junction, which would be elongated 400 feet southward and reconstructed as a "T" intersection; at Duck-On-The-Rock (Sta. 285+00 - 420+00); at Grapevine Canyon (Sta. 445+00 - 512+00); and at Buggeln Hill (Sta. 720+00 - 830+00). Other realignments included Station 830+00 - 910+00 or 910+00 - 950+00 to shift the line slightly closer to the rim, if damage to geologic features was not great; and at Stations 1010+00 - 1035+00, 1045+00 - 1060+00, 1070+00 - 1090+00, 1163+00 - 1180+00, and 1215+00 - 1235+00 for the sole purpose of eliminating dangerous curves. Realignment at Desert View would offer motorists the option of bypassing developments and the parking loop, but a final line change was not determined. Roadway standards would be close to those proposed by Erhart the year before--a 30'-wide roadway with a 22'-wide surface, flanked by 4' stabilized-turf shoulders, and a design speed of 45 mph.[66]

Patraw, French et al decided that East Rim Drive reconstruction would be addressed in three projects, beginning at the junction with South Entrance Road and moving east. They limited the first project to a portion of 1-A, extending to Station 506+23, because they wanted to include final surfacing within or very soon after the initial grading project. Experience with the recently completed South Entrance Road had taught park administration that a thin bituminous-treated surface rapidly deteriorated through a Grand Canyon winter. An immediate final surfacing would prove more cost effective in the long run. A second reason for limiting road mileage in the first project concerned traffic patterns at the intersection with South Entrance Road and at the Yavapai Point spur (along South Entrance Road). Motorists were easily confused at these broad intersections which used only directional pavement striping. The first project would include raised traffic channelization islands at these two locations.[67]

Immediately after the second reconnaissance, BPR engineers began a location survey and specifications, working (as they always did) with NPS landscape architects and park administrators to iron out details of material types, costs, and availability; final approvals of alignment, grades, curves; and other details. An initial advertisement for the project resulted in rejection of all bids. BPR District Engineer B.M. French advertised a second time in April 1956. The new project would include 7.793 miles of roadway, channelization at the two intersections, and additional work at the new visitor center (then under construction) such as drinking fountains and 8,000 square feet of flagstone in front of the building.[68] Although bids on the second go round exceeded estimates by 30 percent, the BPR suggested the contract go to Rogers Construction Company for their low bid of $590,000.00. This amount included only the Schedule B proposal, which did not address bituminous surfacing, so the BPR would have to advertise for surfacing at a later time.[69]

Rogers Construction Company began work on the project 25 May 1956 and completed work 28 June 1957. Costs totalled $624,000.00, approximately $52,000.00 of which covered engineering costs. Rogers completed the project substantially as designed. The roadway from Station 95+68.61 (South Entrance intersection) to 506+23.59 received a 0'-5" to 0'-11" selected borrow base course (full width), overlaid with a 0'-6" crushed gravel base course and bituminous prime coat. Changes from specifications included substitution of NC-2 rather than RC-2 asphaltic oil for bituminous treatment, and a greater amount of obliteration of bypassed roadway than at first envisioned. Flagstone, drinking fountains, and parking lot at the visitor center, islands at the two intersections, and dry rubble masonry curbs and walls were completed as designed.[70]

The traffic islands were created of cut stone masonry curbs on concrete foundations sunk below the bituminous surface, then filled with topsoil and seeded with native Blue Gramma (66%), Smooth Brome (18%), and Bluestem Wheatgrass (16%). The stone, 0'-7" to 0'-9" in height and 0'-6" to 0'-10" in thickness with a 2' minimum length, came from a Western States Stone Company quarry at Ash Fork at $1.25 per foot delivered to the work site. Seed was spread at a combined rate of 7.2 pounds per acre on the islands, as well as road shoulders, cut slopes, embankments, and obliterated roadway along the entire 7.8 miles of new roadway. Park day labor forces completed the traffic islands and seeding, and installed an unknown quantity of guardrails. Some of this work was completed during the surfacing project later in 1957.[71]

This first project to reconstruct East Rim Drive did not include work to spur roads, but did include rebuilding the parking area and dry rubble masonry wall at Duck-On-The-Rock. Here Rogers

shifted the roadway just to the south of the old parking area, which had been located south of the roadway, and built a new pullout and parking area beside the rim.[72]

Surfacing of the 7.8-mile reconstructed roadway immediately followed the Rogers Construction Company project. USDI awarded this contract to Peter Kiewit Sons' Company of Phoenix, Arizona, for the low bid of $205,000.00, which was 21 percent above engineers' estimates. With construction efficiencies, but additional costs of engineering, signs, and striping, final costs totalled $212,000.00. Contractor began work 27 June 1957 and on 18 September 1957 completed a 0'-3", Class F, Type F-1, dense-graded, plant (hot)-mix bituminous surface atop the subgrade to a 22' width at an average rate of 0.57 gallons per square yard.[73]

The method of laying this surface consisted of first applying an emulsified asphalt Grade SS-1 to the existing prime base and bottom surface course as a tack coat at an average rate of 0.06 gallons per square yard. Asphalt cement, 120-150 penetration, was mixed at a rate of 5.86 percent of the weight of mineral aggregate to produce the 0'-2-1/2" bituminous plant mix bottom course. This same material was mixed at an average rate of 6.21 percent of the weight of mineral aggregate to produce a 0'-1/2" bituminous mix finish surface course. Emulsified Asphalt Grade SS-1 was then applied at the average rate of 0.10 gallons per square yard as a flush coat. The contractor then spread an asphalt mulch to the 4' turf shoulders formed in the prior project at an average rate of 0.31 gallons per quare yard.[74]

While the above two projects to reconstruct and surface the first segment of East Rim Drive was underway, park forces undertook a separate project to build and install 21 informational signs at four major junctions along the new roadway and South Entrance Road. The signs, built of 3" x 12" stained redwood stock, averaged 3' x 5' in size and each was affixed to two cedar posts. All letters were 4" high, routed into the redwood, and lacquered. This project was completed between December 1956 and February 1958 at a total cost of $2,542.91.[75]

Even before reconstruction of the first segment began, the BPR continued its survey into the second segment of reconstruction. In this endeavor they were aided by many of the ground stakes intact from the original 1940 survey and by the recent aerial photography which was pieced together to form a mosaic of the proposed line. Park Landscape Architect Charles E. Krueger inspected this preliminary survey in May 1956 and noted in a general way the changes proposed to the existing roadway.[76]

Krueger wrote that alignment from Stations 506+00 through 720+00 would remain basically the same, with improvements consisting of

widening and lesser grades. The line would shift slightly to the north between Stations 645+00 and 670+00 to ease curvature and avoid an existing picnic area in a stand of ponderosa pines. Station 720+00 to 820+00 would at long last evidence a "Buggeln alignment" desired since 1925, with care exercised to avoid one of the lovelier ponderosa pine stands on the south rim. Stations 845+00 through 915+00 would be shifted left to provide more or less continuous rim contact. Concerns of the 1955 survey over disturbance to geologic formations (and Indian ruins) had been abated by an appropriate alignment.

Krueger's remaining observations were of a general nature and not all followed during later reconstruction. His major concern centered on minimal landscape scarring, and toward this end he observed with approbation intentions to balance cuts and fills with required borrow obtained from approved pits; to clear only the actual roadway alignment, with a "small amount of vista clearing" possible; to sow native grasses atop all shoulders and obliterated line and to fertilize, water, roll, and treat the planted areas with asphaltic mulch; to forego guardrails; and to prohibit detours. Drainage would require only CMP culverts with metal end sections and paved gutters along steep grades. Several picnic areas accessed by short spurs would be constructed, and wye intersections at Grandview and Moran point spurs would be replaced with "T"s (The "T" at Grandview was not constructed in the ensuing project, but years later).[77]

The second segment of East Rim Drive reconstruction went out to bid in September 1959 and was awarded to Southern Industries Inc. of Phoenix, Arizona, for the low bid of $801,000.00, which was 2 percent below engineers' estimates. With change orders, extra work orders, and engineering, project costs totalled $899,000.00. Contractor began work 13 October 1959 and completed the project substantially as designed on 18 November 1960. This contract was a grading, base course, and surfacing project to the main roadway from Stations 540+40.02 to 1007+50, that is, from about one mile west of the Grandview spur in an easterly direction for 8.639 miles.[78]

Principal contract work consisted of grading and drainage, then placing a 0'-6" to 0'-15" special subbase the full width of the 28'-wide roadbed, followed by a 0'-6" cement stabilized base course, and 0'-9" untreated, crushed-aggregate shoulders. Surfacing of the 22'-wide wearing course entailed a 0'-2-1/2" bituminous plant mix as a bottom course and 0'-1/2" bituminous plant mix as a finish course. The 20'-wide Grandview and Moran Point spurs received a 0'-2-1/2" bituminous plant mix bottom course, a 0'-1-1/2" levelling course, and a 0'-1/2" bituminous plant mix finish course, along with untreated crushed-aggregate shoulders. The contract also called for construction of parking

areas along the main roadway left at Station 761+33, left at Station 808+50, and left at Station 890+00. The completed roadway contained minimum curvature of 650 feet and maximum grades of 7 percent for tangents of 1,500 and 1,050 feet.[79]

The method of surfacing consisted of applying emulsified asphalt Grade SS-1 to the Portland cement-stabilized base course as a curing seal at an average rate of 0.264 gallons (undiluted) per square yard, and tack coat at an average rate of 0.06 gallons per square yard. Asphaltic cement, 120-150 penetration, was mixed at an average rate of 6.3 percent of the weight of mineral aggregate to produce the 0'-2-1/2" bituminous bottom course and 7.2 percent to produce the finish course. Emulsified asphalt Grade SS-1 was applied to the finished surface as a Type 1 seal at an average rate of 0.10 gallons (undiluted) per square yard. The same material was applied to paved gutters as a Type 3 seal at an average rate of 0.759 gallons (undiluted) per square yard, with 21.19 pounds of cover aggregate used per square yard. Portland cement averaged 2.65 percent by weight of the dry mineral aggregate.[80]

This project included construction of CMP culverts ranging from 18" to 30" in width with metal aprons, drop inlets, cut stone masonry curbs, bituminous walkways, topsoil, seeding, and obliteration of old roadway, but construction reports do not indicate specific locations. It also, at long last, included realignment of the roadway through the Buggeln properties, which had been acquired by the NPS for $50,000.00 in 1948.[81]

After completion of the second segment of East Rim Drive reconstruction, park forces undertook projects to stripe the new roadway and to prepare and install interpretive signs at major viewpoints. Striping consisted of the approximate eight miles of new roadway and was completed at a cost of $808.50. Nine exhibit panels were designed by park naturalists, financed by the Grand Canyon Natural History Association (art layouts only), and created by illustrator Bill Chapman of Gardiner, Montana, at a total cost of $2,426.00. These were installed in five roadside exhibit structures with native stone masonry bases, heavy timber frames, and glass enclosed cases (these structures still exist today at the identified points), built at a cost of $3,234.82.[82]

Two of these panels, entitled "Welcome to Your National Park" and "Grand Canyon Dimensions," were installed in one structure at Mather Point along the South Entrance Road. Two, entitled "The Bright Angel Trail" and "Below the Rim," were installed in one structure at the head of the Bright Angel Trail. Two, entitled "The Kaibab Trail" and "Grand Canyon Beckons," were installed in one structure at the head of the South Kaibab Trail along the Yaki spur road. Two, entitled "Pioneer Enterprises" and "Canyon

Climates," were installed in one structure at Grandview Point. The final sign entitled "Folded Rocks" was installed in one structure at Moran Point. Park forces completed this project between February and July 1961.

The third and last segment of East Rim Drive reconstruction went out to bid in October 1961 and USDI awarded the contract to Northwestern Engineering Company of Denver, Colorado, for the low bid of $982,000.00, which was 2 percent above engineers' estimates. This project included shoulder work to South Entrance Road costing $21,000.00. With change orders, extra work orders, and engineering costs, costs totalled $1,031,000.00. Contractor began work on 21 November 1961 and finished it substantially as designed on 2 July 1963. This contract as it applied to East Rim Drive was a grading, base course, and surfacing project to 8.718 miles of roadway from the end of the second reconstruction segment at Station 1007+50 (about 7.6 miles east of Grandview) to Desert View at Station 1297+49.34, and from that point along Route #10 3.361 miles to the park's east boundary. It also included rebuilt parking areas and spur roads at Grandview Point, Moran Point, Tusayan, Lipan Point, Navajo Point, and Desert View, as well as preparation of a new service station site at Desert View.[83]

Principal contract work consisted of grading and drainage where required, followed by a 0'-6" to 0'-15" special subbase the full width of the 28'-wide roadbed. A 22'-wide crushed aggregate base course was then laid and 3'-wide untreated shoulders rebuilt on both sides. Emulsified asphalt Grade SS-1 was applied to the base coarse as a tack coat at an average rate of 0.08 gallon per square yard. Surfacing consisted of a 0'-2-1/2" bituminous plant mix bottom course, 120-150 penetration, mixed at an average rate of 6.5 percent of mineral aggregate weight and 0'-1/2" bituminous plant mix surface course of the same mixture. A Type 1 seal coat of Grade SS-1 was applied at an average rate of 0.10 gallon per square yard. Paved gutters and shoulders received a Type 2 seal coat of Grade MC-5, applied at an average rate of 0.25 gallon per square yard.

At the completion of this project, BPR engineers S.E. Farin and R. Kienitz commented that the untreated shoulders along East Rim Drive (all gravel in 1963) should be improved by building them up to the level of the roadway surface then applying an asphalt aggregate mix. These men felt that shoulders should be paved because park visitors--now exceeding a million per year--had the habit of "consistently exceeding" the 45 mph limit and that when vehicles crossed over to the gravel shoulders they were often thrown out of control. These same visitors often parked along the roadway as well, resulting in shoulder damage over time. The engineers recommended this safety measure "regardless of esthetic

or other considerations."[84] It is unknown if this advice later translated into roadway changes, but one will note today that there is very little gravel shoulder room along East Rim Drive where one would dare leave the paved roadway.

With the completion of the third segment of roadway in July 1963, the NPS had reconstructed the entire length of East Rim Drive and had begun to refer to the roadway by that name rather than the "Grand Canyon-Desert View Road." Although it would always retain its designation as Grand Canyon Route #1, this name became more of a construction label (such as 1-A1, 1-A2, and 1-B) while in everyday parlance, "East Rim Drive" prevailed. The approximate 3.5-mile roadway from Desert View to the park's east boundary also retained its designation as Grand Canyon Route #10, and still is, on occasion, referred to as the East Entrance Road, but has since the 1960s been considered in most communications as a portion of East Rim Drive. This stems from the evolution of the roadway from a scenic drive ending at Desert View to a continuous modern highway running uninterrupted from the South Entrance Road to Arizona Highway 89 at Cameron, Arizona. This continuity is, in fact, recognized by the state as one highway: Arizona Highway 64.

Most of the alignment of East Rim Drive has remained as reconstructed in 1956-63, but modifications necessitated by increasing traffic, vehicle weights, and simple maintenance have occurred. NPS day labor forces striped the final reconstruction segment in summer 1963, and continue to stripe the entire roadway on an annual basis. Day labor forces also installed directional signage along the final segment and completed the east boundary sign (the one seen today) in summer 1963.[85]

Following reconstruction of the third roadway segment, NPS forces built and installed interpretive signs at several points, as they had in 1961 along the second segment of roadway. From February to June 1963, park naturalists prepared the text, Grand Canyon Natural History Association paid for the art layouts, and Bill Chapman illustrated seven roadside exhibit panels at a total cost of $1,930.25. NPS crews built five exhibit structures of native stone masonry on concrete foundation slabs with heavy timber frames and glass-enclosed cases (as seen today) at Desert View, Lipan Point, Moran Point, Grandview, and Pima Point (along West Rim Drive) at a total cost of $4,160.07. Construction of one of these structures at Grandview in 1963 seems to conflict with an earlier report that one was built here in 1961. The author is inclined to believe that the structure was built in 1961, since panels are reported to have been installed in that year and not in 1963.[86]

Interpretive panel installations in 1963 included two within one structure at Pima Point, entitled "Colorado River Rapids" and "Birds"; one within one structure at Park Headquarters entitled "A Canyon Profile"; two within one structure at Desert View entitled "Vanishing Rock Layers" and "Ruins and Reservations"; and two within one structure at Lipan Point entitled "Contrasting Landscapes" and Ancient Rock Records." It is assumed panels were created later and installed within the Moran Point structure.

A separate contract was awarded Bish Construction Company of Phoenix, Arizona, in summer 1963 to reconstruct campground roads and parking in the Desert View developed area (Mather Campground was included in this project). Bish worked from July through November 1963 to complete 2,467.5 linear feet of 20'-wide and 2,150 linear feet of 12'-wide secondary roads at Desert View. This project appears to have ended the road work completed during the seven-year-long reconstruction of East Rim Drive.[87]

The NPS provided a finishing touch to the 1956-63 reconstruction of East Rim Drive with a new east entrance station completed in 1964. In one of the more unfortunate construction projects of the Mission 66 era, the park replaced its rustic-style masonry and log station with cheap, box-like structures similar in concept to those built along the South Entrance Road several years prior. In this project only two of the three structures seen today were built, along with the walkway and eastern-most island.[88]

The entrance station on the east was constructed of frame, plywood, gypsum board, wire mesh, and stucco essentially the same as seen today with a porch cover and 4'-wide walkway. Electricity to the flat-roofed, pueblo-style building was connected within this project while water and sewer lines were installed at a later date. Upon completion, the $9,744.00 structure served as the Desert View subdistrict ranger station as well as entrance station.

The eastern-most entrance kiosk ($3,248.00) was also constructed of frame, plywood, gypsum board, wire mesh, and stucco, and in features such as window and door openings, roof line, and size, was essentially the same as seen today, other than the siding. Comparison of today's structure with that completed in February 1964 suggests that the building is the same, but the stucco finish was removed at an unknown date and replaced with wood siding. This kiosk was built upon a traffic channelization island surrounded by masonry curbing designed to match that along other sections of East Rim Drive. The island on the south side of the kiosk (entrance side) was also surrounded by post and W-beam guardrail. A 10'-wide entrance lane separated the kiosk island from the masonry-curbed, entrance station walkway, and the

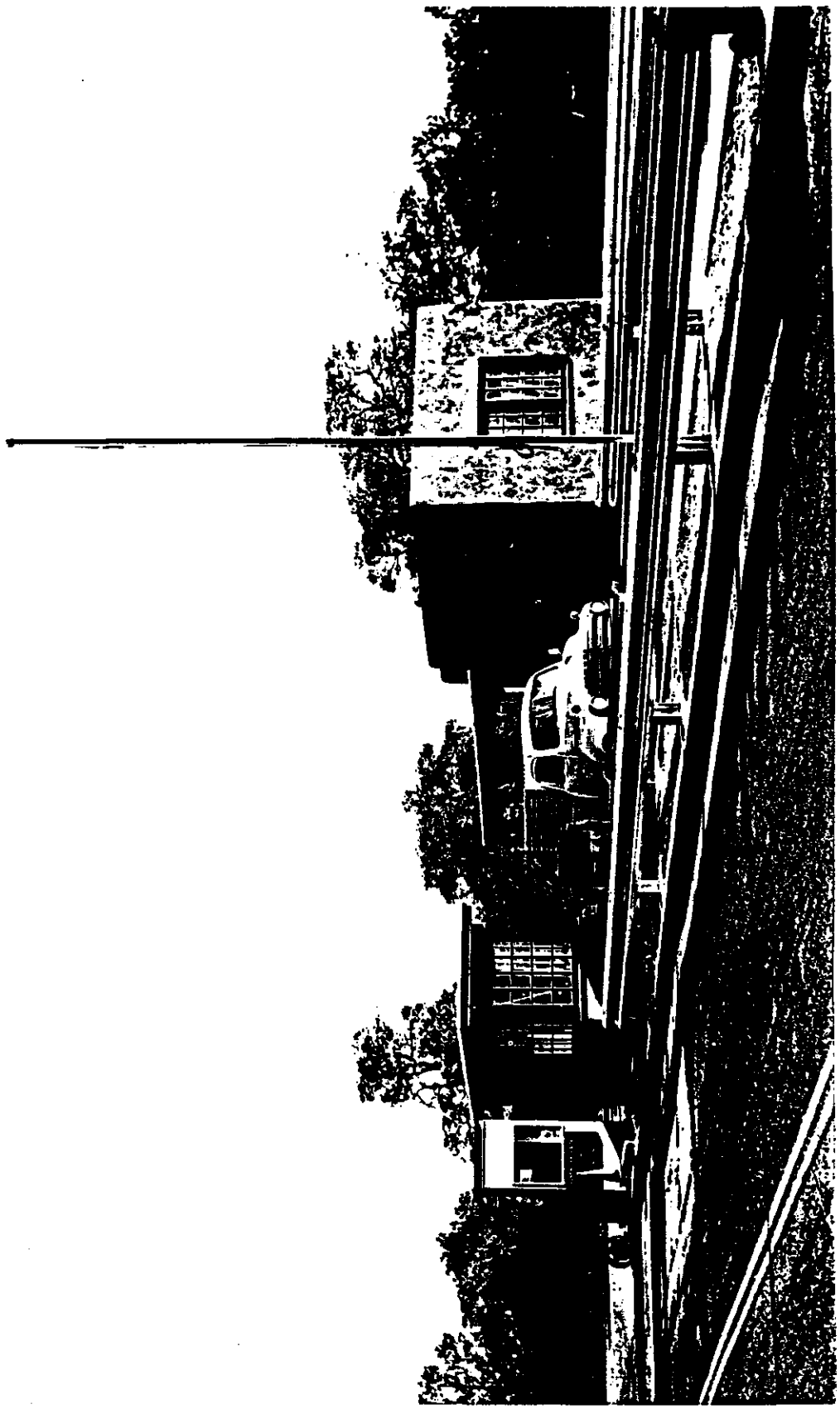


Figure 19. East Entrance Station nearing completion, 1963.
(GRCA Image #4525F, GCSC)



Figure 20. East Rim Drive after a seal coat, and new directional sign to Tusayan Museum, August 1966. (GRCA Image #4872, GCSC)

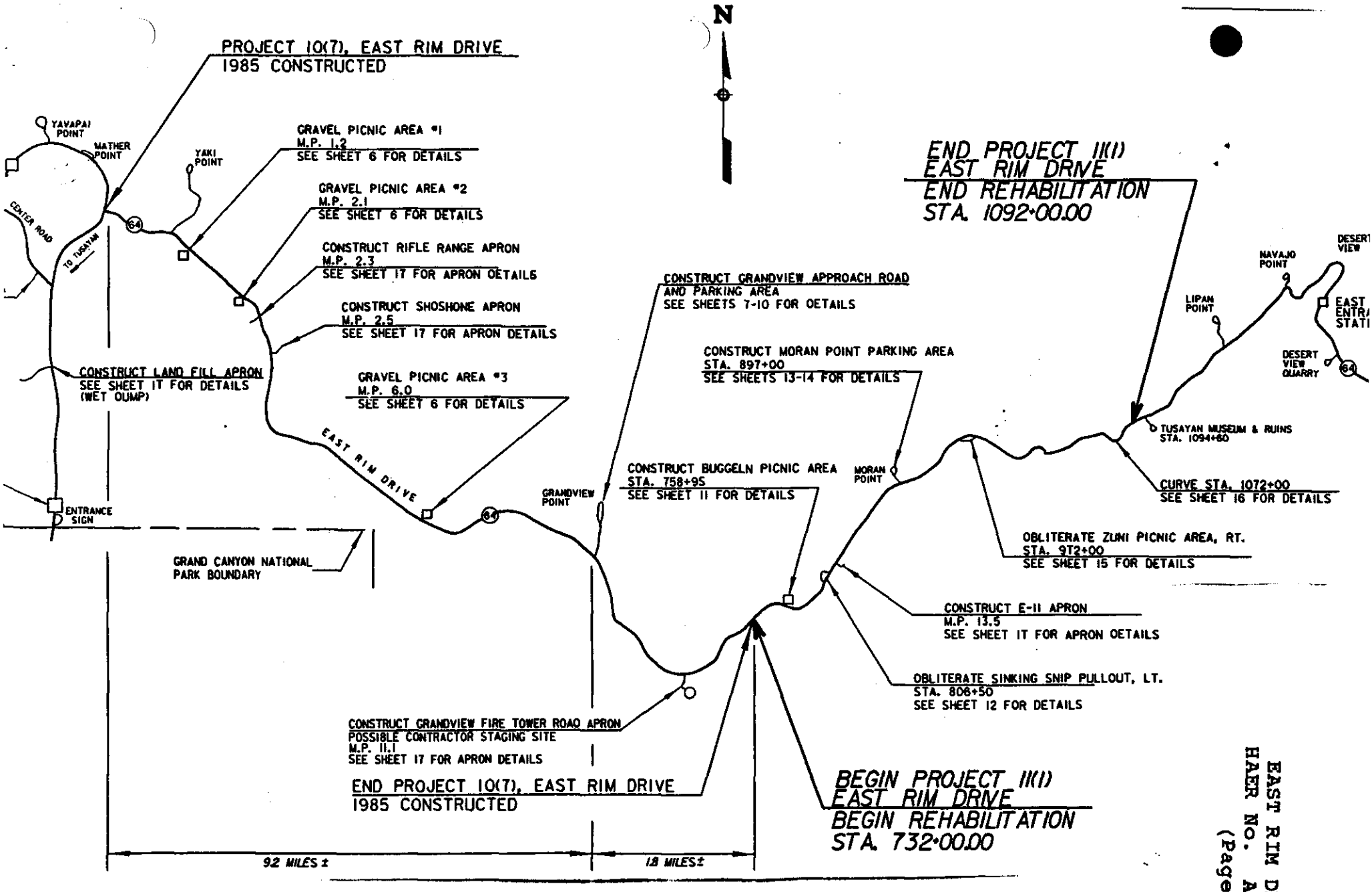


Figure 21. Recent reconstruction to East Rim Drive, showing completed 1985 project on the left, proposed 1990 project on the right. (From "Plans for Proposed Project 11(1)," Prof. Services)

roadway portion immediately between the two structures was designed as an 0'-8"-deep concrete apron without asphalt surfacing.[89]

Plans drawn in 1961 illustrated a second kiosk, island, and traffic lanes which would be built at an undisclosed future date. The second building and island would match the first with another 10'-wide entrance lane and a 10'-wide exit lane on the far west side, both containing 0'-8"-deep concrete aprons. This is basically what exists today, but this study did not reveal dates of construction.[90]

For nearly thirty years following the 1956-63 period of reconstruction, work along East Rim drive consisted of standard maintenance such as chip-sealing on an approximate 7-10 year cycle, oil and asphaltic patching, roadway striping, curb and wall repairs, culvert and ditch clearing, and shoulder rounding. As the number of annual visitors climbed steadily from a few more than a million in the early 1960s to three million in the 1980s, chip seal surfacing maintained the smooth ride to which motoring tourists had become accustomed. At Grand Canyon the ship seal process has generally consisted of poured CRS-2 asphaltic oil with a polymer, overlaid with shattered aggregate chips to twice the oil depth, then rolled. As an aesthetic touch, park crews have used native, light-colored aggregate which after wear gives the roadway an off-white appearance sympathetic to the surrounding Kaibab Limestone.[91]

By the middle 1980s, chip-sealing alone could not keep up with the more than three million visitors plying East Rim Drive in automobiles, buses, motorhomes, and house trailers, and the park initiated another series of reconstruction projects. The first project finished in 1985 entailed rehabilitation of 11 miles of roadway and parking areas from the South Entrance Road east as far as Station 732+00. Standards for the main roadway appear to have been the same as a later segment, that is, removal of the top 0'-6" of pavement, repair of the subgrade as required, and resurfacing to a width of 26' with 11' lanes and 2' shoulders.[92]

The only main roadway realignment noted for this project involved a new intersection and roadway beginning several hundred feet north of the line constructed in the 1950s. NPS Roads Supervisor Joe Bice recalls that the old East Rim alignment used to approach South Entrance Road on a curve, and motorists had a tendency to fly right across the intersection into the trees. Mr. Bice remembers the new intersection (today's) being built more or less in the image of the old, with landscaped traffic channelization islands. The new, straighter road alignment provided ample sighting distance to the new intersection.[93]

The 1985 project also included improvements to three picnic areas, construction of three spur road aprons, and reconstruction of the Grandview spur and parking area. Workmen reshaped and compacted 0'-3"-deep aggregate surfaces at existing picnic areas located at Mile 1.2 (right), Mile 2.1 (right), and Mile 6.0 (left), then placed a 0'-3"-deep aggregate surface over the old. They did not disturb existing timber guard rails and bollard posts which surrounded these picnic areas, nor the paved aprons leading from the main roadway. Road crews constructed new paved aprons from the main roadway onto the spur roads leading to the rifle range (Mile 2.3 right), Shoshone Point (Mile 2.5 left), and the Grandview fire tower (Mile 11.1 right). These aprons were designed with a 25'-radius curve from each end of the main road and 15 linear feet of additional asphalt up the spur beyond the radius point.[94]

The Grandview spur road was realigned at its intersection with East Rim Drive to convert the existing wye intersection to a "T" type. Workmen completed this task with minimal impact by running the new line to the southeast of the landscaped wye island, removing all asphaltic materials, grading the old alignment to natural contours, and planting native grasses and shrubs. The spur roadway was excavated to a depth of 0'-6", then overlaid with a tack coat, prime coat, and 0'-5" hot asphaltic concrete, creating a 22'-wide roadway which sloped 2 percent from the crown with 10'-wide lanes and 1' shoulders. Exceptions at Stations 10+10 - 16+00 and 46+25 - 51+10 included a 30' graded width with a 30'-wide, 0'-6"-deep aggregate base beneath the asphaltic concrete.

The Grandview parking area underwent considerable reconstruction which included complete replacement of the roadway and parking area. Existing pavement was excavated to a 0'-6" depth, then replaced with two 0'-3"-deep asphaltic courses. The terminal loop was realigned on the west side as was the spur entering the loop area. This had the effect of elongating the loop from north to south to provide more parking and allow easier ingress and egress. All old lines were obliterated, regraded to natural contours, and seeded. Other considerable modifications at this point included elimination of some masonry curbing, rebuilding of asphaltic sidewalks, a new walkway through the center of the loop north to south, culverts and drop inlets, 2,005 linear feet of additional masonry curbing, and more parking room including two handicap spaces and an accessibility ramp. Note that masonry walls and some curbs dating to the 1930s were left undisturbed, and specifications for this project did not call for new masonry walls.[95]

The U.S. Department of Transportation, Federal Highway Administration completed plans and specifications for the second

segment of recent reconstruction from Station 732+00 to 1092+00 (just west of the Tusayan spur) in April 1990. Reconstruction consisted of excavation to a depth of 0'-6", pulverizing the old bituminous surface, and using the recycled material to lay a base averaging 0'-6" in depth and 28' in width. After spreading prime (Grade MC-250, 0.3 gallon per square yard) and tack (Grade CSS-1H, 0.05 gallon per square yard) coats atop the base, a 0'-3"-deep hot asphaltic concrete pavement (Grade AC-10, 6 percent asphaltic cement) was applied to form a 26'-wide paved roadway sloping 2 percent from the crown with 11' lanes and 2' shoulders. A 1' shoulder of aggregate with a 4:1 slope was added to each side of the roadway after surfacing. Specifications called for a Type 1 seal coat (emulsified asphalt, Grade CSS-1H) spread at 0.12 gallon per square yard (50 percent water dilution) and 10 pounds of blotter material per square yard, but its use was left to the discretion of the supervising engineer.[96]

This project also called for the obliteration of Sinking Ship Pullout at Station 806+50 left, obliteration of Zuni Picnic Area at Station 972+00 right, reconstruction of the Buggeln Picnic Area at Station 758+95, rebuilding of the Moran Point spur and parking area, construction of a paved apron to a spur road at Mile 13.5, and modifications to a curve at Station 1072+00.[97]

Specifications for the obliteration of Sinking Ship Pullout consisted of removal of all asphalt and stone curbing within the pullout and regrading to natural contours. Barrier rocks were placed along the roadway and a masonry curb constructed from Station 805+30 to 808+40. An 18" x 60' CMP culvert under the roadway at Station 806+80 was removed and a curb cut notched in its place, draining directly to the Canyon rim. Obliteration of the Zuni Picnic Area consisted solely of scarifying and regrading the existing loop to natural contours and placing barrier rocks along the main roadway.[98]

Specifications for rebuilding the Buggeln Picnic area included a new 0'-6" aggregate base, prime coat, and 0'-3" hot asphaltic concrete pavement to the existing loop road and parking area. The existing asphaltic sidewalk and stone curbing on the north side of the loop were replaced with a new 6'-wide, 130'-long asphaltic concrete walkway and 0'-6"-high stone curb. A 24'-wide travel way to access the 20'-deep parking area on the north side tapered to a 16'-wide travel way on the south side of the loop. Two handicap parking spaces and an accessibility ramp were added to the northwest side of the parking area. The existing sign and island remained untouched. A total of 770 linear feet of new curbing surrounded the island and picnic loop. A pavement taper, widening from east to west, was constructed on the north side of East Rim Drive at the picnic area entrance.[99]

Moran Point spur road reconstruction consisted principally of converting the former wye intersection with East Rim Drive to a "T" type. In this instance, the new alignment ran straight through the old landscaped island to meet East Rim at a 90 degree angle. Surface and base materials of the former wye approaches on the east and west were removed, and the old roadways regraded to natural contours. Existing pavement and base materials of the spur roadway were torn up, pulverized, and recycled as a new 0'-6"-deep base, to which a prime coat, tack coat, and 0'-3" of hot asphaltic concrete were applied to form a 22'-wide roadway sloping 2 percent from the crown with 10'-wide lanes and 1'-wide shoulders. The first 300 feet of the spur road was constructed the same way, but with a base 28' wide to accommodate additional 3'-wide, 4:1 sloping shoulders. Material mixtures and types were the same as used on the Grandview spur.[100]

The Moran Point parking area was not substantially reconfigured but was almost entirely reconstructed. All pavement was torn up to a depth of 0'-3", pulverized, and recycled as base material. The area was then bladed, shaped, and resurfaced with a prime coat and 0'-3"-deep layer of hot asphaltic pavement. Existing masonry walls were not disturbed, but 70 linear feet of existing curbs were removed on the west side of the parking area and 535 linear feet of curbing added. The existing asphaltic walkway was replaced with a 6'-wide, 0'-2"-deep asphaltic concrete sidewalk flanked by the old walls and curbs. Two handicap parking spaces were added along with an accessibility ramp. Travel ways around the loop were widened, but it does not appear that the number of parking spaces were increased.[101]

The curve at Station 1067+25 - 1074+88 was not realigned, but modified for safety and improved drainage. Features of this reconstruction included widening the paved surface to 31' with 11'-wide lanes, a 4'-wide outside shoulder, and a 6'-wide paved inside gutter flanked by masonry curbing. The roadway was superelevated 6 percent and weathering steel W-beam guardrails installed from Stations 1069+00 to 1073+50. One poorly placed drop inlet was removed and associated 24" CMP culvert plugged with concrete. One new drop inlet and 24" x 52' CMP culvert was installed at approximate Station 1068+00.[102]

DESCRIPTION

East Rim Drive as constructed in 1927-31 began at Village Loop Drive beside the old Superintendent's residence, nearly two miles west of its modern intersection with South Entrance Road. For nearly thirty years this segment retained its designation as East Rim Drive until the 1950s witnessed developments in the vicinity of today's visitor center. With construction of the new South

Entrance Road in 1954 to access these facilities, the segment between Stations 0+00 (at Village Loop) and 95+68 became the terminal portion of the entrance road and remains so today. Description of that segment is included in HAER No. AZ-45, South Entrance Road report.

East Rim Drive since the 1950s begins at the 1985 reconstructed intersection with South Entrance road and continues generally southeast then northeast to Desert View, thence south-southeast to the park's east boundary. As revealed in the early part of this report, the road was originally constructed as a scenic drive, but its alignment was actually a compromise between scenic views and occasional vistas and 1920s standards for automobile roads with easy grades and curves. Although exact alignments have changed considerably over the years, and concern has shifted more in favor of modern highway standards with more and heavier vehicles, increased speed limits, and use as an entrance road, the general alignment has retained this compromise between scenery and safety.

East Rim Drive's continuing dual purpose helps explain why it follows its existing course and appears the way it does. This is not an extreme curvilinear scenic drive like Zion National Park's Zion-Mount Carmel Road or Mt. Rainier's Going-to-the-Sun highway where steep switchbacks are the rule and vistas afforded at every turn. Although topography dictates these roads' alignments and scenic features, and in comparison the south rim of Grand Canyon is reasonably flat, NPS and BPR planners could very well have constructed a slow speed, curvilinear road along the Canyon rim. Instead, they deliberately built East Rim Drive back from the rim, but not too far back, so that the flattest country between invasive Canyon tributaries to the north and deepening washes to the south could be traversed in long tangents and high radius curves.

This construction strategy also fit into the NPS goal of leading a roadway through picturesque terrain and disturbing the natural landscape as little as possible. The south rim of Grand Canyon is anything but flat, but East Rim Drive's alignment follows the flattest terrain available. This mitigates the need for roadway cuts and fills, and although there are some of these, engineers and landscape architects since the 1920s have designed steeper grades than necessary to reduce the number and consequent scars. CCC and park forces have consistently rounded unavoidable cut slopes, rounded shoulders and ditches, obliterated old road scars, and seeded any bare patch of earth that caught their eye. The result is a roadway that is for the most part unobtrusive to the visitor's eye as it wends its way through long miles of greenery.

East Rim Drive's location strategy also entailed consideration of geologic and vegetative types, an optimum (not maximum) number of scenic views, and, at least in this author's opinion, a conscious decision to provide scenic viewpoints rather than scenic vistas. The roadway pierces landscape shaped by topography which ranges in elevation from above 7000' to below 5000'. Along the thirty-sixth parallel, this results in a transition zone between pinon-juniper and ponderosa pine, varying with the slope of the land. Terrain tends to slope downward for a few hundred feet from Grand Canyon's south rim, which results in pinon pine, juniper, shrubs, grasses, and even some cacti dominating the landscape even at the higher elevations. A few hundred feet south of the rim, terrain is often broken by typically shallow washes and gullies producing north facing slopes which favor ponderosa pines. East Rim Drive, because it remains generally away from the rim, passes through a maximum distance of ponderosa forest which, most people would agree, is a more attractive landscape.

As noted earlier, the NPS and BPR could have built East Rim Drive along the rim to take in uninterrupted vistas, but chose instead to have the main roadway brush the rim briefly only where tributary canyons form receding bays. These rim contacts are typically short, views limited by nearby canyon walls, and to a motorist passing at 45 mph present little more than a glimpse of the geologic wonder even if rimside trees were removed. At these points East Rim Drive offers roadside pullouts where the motorist must stop, leave his vehicle, and saunter a few yards to rimside railings to admire the view. Historically, brush but not trees have been cleared at these viewpoints, thus, the moving motorist sees nothing for the trees; the ambulatory motorist sees all that there is to see.

Another facet of these pullouts, one which the author believes glimmered in the minds of landscape architects but never made it to the printed page, lies in constricted views which offer intimate moments with the Canyon. It is difficult enough even at these limited viewpoints to understand what meets the eye, but the visual limitation does focus one's attention on the magnitude of sheer Canyon walls, the complexity of geologic formations, myriad colors, shadow, and light.

Comparatively narrow views availed at East Rim Drive pullouts are balanced by indescribably broad views offered at several scenic points reached by the roadway's spur roads. Tourism pioneers identified nearly all of these scenic points long before the NPS arrived at Grand Canyon, and built crude horse trails and wagon roads to some of them by the turn of the century. The NPS from its earliest years considered these points essential to tourist enjoyment, and designed spur roads to all but Moran Point in its earliest 1927-31 version of East Rim Drive. These spurs have

consistently been built and rebuilt to modern highway standards, though usually narrower, and have always been considered integral parts of East Rim Drive itself. Again conjecturally, those concerned with aesthetic appreciation of the Canyon deliberately balanced main roadway pullouts with spur loops to suggest to park visitors the intimate as well as the distant. Only exposure to both affords any hope of appreciating Grand Canyon.

East Rim Drive in an engineering sense suggests what designers had in mind all along: a streamlined highway through a half tunnel of flanking trees which keeps motorists moving and mellow. The roadway eastward to Station 1092+00, from the South Entrance Road intersection to a point just west of the Tusayan museum spur, retains its 26'-wide surface with 11'-wide lanes and 2'-wide shoulders. Beyond that point to the east, engineering dates to the early 1960s with a 22'-wide surface, 10'-wide lanes, and 1'-wide shoulders. All in all, ample lanes, easy grades, and sweeping, well-superelevated curves; narrow, precipitous gravel embankments; and strategically-placed pullouts, scenic point spurs, and picnic areas ensure that the park's nearly five million annual visitors--almost all of whom motor along East Rim Drive at least once during their stay--do not turn the roadway into a parking lot. Even lumbering motorhomes and diesel-spewing tour buses seem to maintain (or exceed) the 45 mph speed limit. In nearly a dozen trips along the drive in summer 1994, the author noted that impromptu, unintentional auto caravans never exceeded four or five vehicles in length, even though there are few tangents with sight distance sufficient to pass.

Because East Rim Drive is recently engineered and reconstructed with few hazardous curves, it exhibits few roadside structures much less structures of an historical nature. All culverts noted during this project are of recent vintage: CMP pipe of varying widths, some with cantilevered end sections jutting from the sides of fill slopes, some with Armco metal aprons, none with masonry or concrete headwalls. Segments of guardrail are also of the newer type: weathering steel, W-beam rails bolted to wood posts and blocks have replaced the whole-log rails of the 1930s and 1940s. The noticeable exceptions to the non-historical rule are retaining walls and parapets found at the several pullouts along the main roadway. Some of these dry rubble masonry walls, as noted earlier, can be attributed to the road's original 1927-31 contractors, some to CCC crews of the 1930s, and at least a few to more modern reconstruction by park forces and the Youth Conservation Corps.

More structures of an historical nature are to be found along the spur roads to scenic points and especially astride the parking loops and viewpoints at the end of these spurs. As noted earlier, these spurs and parking loops were heavily reconstructed

in the late 1950s/early 1960s and again in 1985/early 1990s, but some masonry curbs and most masonry walls and metal railings date to the 1927-39 time period.

Early contractor, NPS, and CCC reports do not detail exact locations of masonry construction (except as noted earlier in this report), but the type of masonry found at any one site is an indicator of its builder. Dry rubble, one might say "sloppy," stacked-stone walls can often be attributed to 1920s and early 1930s contractors who used rugged, generally uncut, stone and no (or very little) mortar to meet contract requirements. These walls closely mimic natural geologic features, so much so that CCC crews on at least two occasions had to repair them due to severe "erosion" less than twelve years after they were built.

CCC walls reflect a transition between the earlier type dry rubble masonry (little of which exists along East Rim Drive) and NPS cement masonry styles which emerged in the 1950s. CCC walls are usually built of roughly-cut limestone--well-mortared, nicely pointed (shadowed), and durable. Some CCC walls, however, such as the two found on the west side of Village Loop Drive, are of a cruder construction. Modern NPS masonry walls and curbs always exhibit sharp edges, are well-laid and mortared, and alternately built of hard sandstone or Kaibab Limestone. Most walls at the scenic points along East Rim Drive can be attributed to the CCC; most curbs to the NPS.

Some fine examples of CCC masonry walls are found at Grandview Point, along the bituminous walkway leading to the point and at the Canyon rim itself. The wall along the walkway features a "step up" top layer to match the walkway's upward slope toward the parking area. A "fine" example of James Vallandingham's masonry work is seen today along the first pullout, about 0.2 mile from the South Entrance Road. This wall is falling apart. NPS masonry curbs are found lining the parking areas and islands at each of the scenic points, although some of these curbs date to the earlier period. The award for poorest masonry work along East Rim Drive goes to the so-called masons who extended the CCC wall along the walkway to Moran Point. Here the contrasting stone type of the NPS and CCC is juxtaposed, but it is likely the new masonry atop the old was completed by a Youth Conservation Corps crew working here in 1977. They were clearly unsupervised.

CONCLUSIONS/SIGNIFICANCE

East Rim Drive is significant as an early and continuing example, of the cooperative agreement between the National Park Service and Bureau of Public Roads (Federal Highway Administration) to build quality automotive roads within the national parks. It is one of five Grand Canyon roads surveyed, designed, and supervised by BPR engineers and NPS landscape architects in the years 1924-31. Although many of its original associated structures have been lost, it retains a number of masonry walls and curbs which date to construction in 1927-31 and to the Civilian Conservation Corps of the 1930s.

Unlike West Rim Drive (HAER No. AZ-42) which retains its original alignment and most of its historic structures, East Rim Drive along with its pullouts, spur roads, and parking loops have been extensively realigned and reconstructed over the years. This fact detracts somewhat from its physical historical significance, yet adds to its importance as an illustration of the continuing relationship between the NPS and BPR. East Rim is a long roadway which has been reconstructed twice within more than a dozen projects, and has required closer interaction and cooperation among engineers, architects, administrators, and concessioner than any other Grand Canyon road. As this report illustrates, the productive relationship among these groups with sometimes disparate interests has resulted in a fine roadway fulfilling its dual purpose as a scenic as well as park entrance highway.

Like West Rim Drive, East Rim also achieves significance as an example of scenic roads deliberately constructed without scenic vistas from the roadway itself. As illustrated (and conjectured) in this report, NPS architects and BPR engineers spent considerable effort balancing the need for a high speed entrance road with a desire for scenic viewpoints. After considerable deliberation, early U.S. Forest Service and later NPS and BPR personnel decided on a mostly interior road which would speed traffic along, in combination with ample picnic areas, turnouts, spur roads, parking loops, and pedestrian viewpoints to offer scenery in a more casual and safe manner. East Rim Drive has retained this dual purpose through the years, despite the park's need to streamline the roadway as it gained in importance as an entrance road.

ENDNOTES

1. W.R. Mattoon, Forest Examiner, "A Working Plan for Grand Canyon National Monument," 105-page report with illustrations, 23 June 1909, copy in Professional Services, GCNP, 5, 38-39, 42-48.

2. J. Donald Hughes, In the House of Stone and Light: A Human History of the Grand Canyon (Grand Canyon Natural History Association, 1978), 57.

3. GRCA Map 27727, Grand Canyon Study Collection (GCSC); M.R. Tillotson, to the Director, letter, 24 December 1931, Misc--Old Roads & Trails in the Park 1923-1944, Grand Canyon National Park Library (GCNPL).

4. "Report of Director of National Park Service for fiscal year ended June 30, 1920," [1920], copy of page 126 in Reference File--Roads, GCNPL; W.W. Crosby, superintendent, to George W. Kimball, forest supervisor, letter, 27 November 1923, Misc--Construction D30--Desert View Road Nov, 1923-Nov, 1927, GCNPL; Superintendent's Annual Report, 1919-20.

5. Superintendents' Annual Reports, 1920-1927. Each year's report contains a factual statement of road conditions along with direct or subtle complaints.

6. Superintendents' Annual Reports, 1920-23.

7. Superintendents' Annual Reports, 1923-25; Stephen Mather to J.R. Eakin, letters, 9 February 1925 and 28 February 1925, Misc--Construction D30--G.C. Desert View Road Nov, 1923-Nov, 1927, GCNPL. Special federal legislation in 1924 allocated $1,500,000 per year for five years to the national parks for new road construction. This boon along with the agreement with the BPR ignited the GCNP roadbuilding era of 1925-39.

8. M.R. Tillotson to J.R. Eakin, memorandum, 23 February 1924; J.R. Eakin to the Director, letter, 18 December 1924; Arno Cammerer to Mr. Eakin, letter, 5 January 1925; J.R. Eakin to the Director, letter, 9 January 1925; all in Misc--Construction D30--G.C. Desert View Road Nov, 1923-Nov, 1927, GCNPL.

9. Fred Harvey to the Director, letter, 13 January 1925; J.R. Eakin to the Director, letter, 26 January 1925; Stephen Mather to Mr. Eakin, letter, 9 February 1925; J.R. Eakin to the Director, letter, 13 February 1925; Mather to Eakin, telegram, 26 February 1925; all in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

10. Stephen Mather to Mr. Eakin, letter, 28 February 1925; J.R. Eakin to R. Hunter Clarkson, letter, 3 March 1925; George C. Bolton to the Director, letter, 11 March 1925; all in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

11. Donald Evans to George C. Goodwin, survey summary (letter), 19 April 1925; J.R. Eakin to the Director, letter, 21 April 1925; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

12. J.R. Eakin to the Director, letter, 21 April 1925; unsigned letter to Mr. Demaray, 6 May 1925; J.R. Eakin to the Director, letter, 10 May 1925; J.R. Eakin to Martin Buggeln, letter, 24 November 1925; J.R. Eakin to C.G. Morrison, letter, 4 December 1925; J.R. Eakin to Martin Buggeln, letter, 21 February 1927; all in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

Eleven miles of the old road to Desert View ran through national forest lands. It was difficult to get the USFS to maintain these miles, and red tape limited what the NPS could do on lands outside the parks. This is why the park wanted the entire road within its bounds, wanted to change the boundary, and one reason why they wanted a right of way through Buggeln's property.

13. J.R. Eakin to Martin Buggeln, letter, 21 February 1927; J.R. Eakin to C.G. Morrison, letter, 21 February 1927; Stephen Mather to Mr. Eakin, letter, 8 March 1927; A. E. Demaray to Mr. Eakin, letter, 19 March 1927; J.R. Eakin to J.B. Wright, County Engineer, letter, 24 March 1927; all in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

14. [Albright] to L.I. Hewes, BPR, letter, 2 June 1927, Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

15. M.R. Tillotson to H.M. Albright, letter, 13 June 1927; Horace Albright to M.R. Tillotson, letter, 21 June 1927; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

16. [Eakin] to Mr. Ford Harvey, letter, 27 March 1927; J.R. Eakin to the Director, letter, 11 April 1927; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

17. J.R. Eakin to U.S. Surveyor General, letter, 29 March 1927; C. Horton, engineer, to J.R. Eakin, letter, 1 April 1927; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

18. Kenneth Dickerson to Tillotson, letter, 22 June 1927; M.R. Tillotson to Alexander T. Sokolov, letter, 1 July 1927; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

19. C.H. Sweetser, BPR District Engineer, "Notice to Contractors," a request for bids, [November 1926]; J.R. Eakin to J.M. Shirley, letter, 30 December 1926; J.R. Eakin to Stephen Mather, memorandum, 12 November 1926; all in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL.

20. J.R. Eakin to J.M. Shirley letter, 30 December 1926; M.R. Tillotson to the Director, letter, 3 May 1927, Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL; W.R.F. Wallace, Associate Highway Engineer, "Final Construction Report (1927-1928) on Grand Canyon National Park Highway System, Sections 1A1, Rectification and Surfacing, 1A2, 2A1, 2B Grading and Surfacing, 2A2 Surfacing and 1C2 Grading," 1929, GCSC.

21. Wallace, "Final Construction Report (1927-1928)."

22. C.H. Sweetser, District Engineer, "Standard Government Form of Invitation for Bids," 26 April 1927; H.K. Bishop to Stephen Mather, letter, July 1927; both in Misc--Construction D30...Nov, 1923-Nov, 1927, GCNPL; "Final Time Statement," a single sheet tally of Pearson & Dickerson project, [December 1930]; M.R. Tillotson to the Director, letter, 20 November 1928; C.H. Sweetser to L.I. Hewes, letter, 4 August 1926; all in Misc Construction D30--G.C. Desert View Road Jan, 1926-Dec, 1931, GCNPL.

23. Sweetser, Invitation for Bids, 26 April 1927; Sweetser letter, 4 August 1928; W.R.F. Wallace, "Extra Work Order and Agreement No. 1", 23 August 1927, Misc--Construction D30--G.C. Desert View Road Jan, 1926-Dec, 1931, GCNPL.

24. F.A. Kittredge, Chief Engineer, to M.R. Tillotson, letter, 9 June 1928; C.G. Morrison, Highway Engineer, to M.R. Tillotson, letter, 21 June 1928; C.H. Sweetser to M.R. Tillotson, letter, 23 June 1928; Horace Albright to M.R. Tillotson, letter, 29 June 1928; C.H. Sweetser, "Standard Government Form of Invitation for Bids," 23 June 1928; M. R. Tillotson to the Director, letter, 20 July 1928; all in Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL.

25. M.R. Tillotson to Assistant Director [Albright], letter, 27 July 1928; [Albright] to L.I. Hewes, letter, 12 August 1928; both in Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL.

26. W.R.F. Wallace to C.H. Sweetser, letter, 3 August 1929, Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL.

27. Wallace letter, 3 August 1929, with attached estimates.

28. C.H. Sweetser, "Standard Government Form of Invitation for Bids," 3 June 1930; USDI, NPS, "Bid, Contract, and Bond for National Park Road Construction, Project Grand Canyon National Park

Route #1, Oil-treated, Crushed rock Surfacing, 1-A3, B, C, D, F, Surfacing," [1930]; USDI, NPS, "Standard Government Form of Contract, Lord & Bishop, Contractor, for Road Construction, Sections A3, B, C, D, and F of Route #1, Grand Canyon-Desert View in Grand Canyon National Park; all in Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL; Superintendent's Annual Reports, 1930-31, 1937-38.

29. USDI, NPS, "Standard Government Form of Bid," received from Heitsch & Bitton, 1 September 1931; USDI, NPS, "Standard Government Form of Contract," with Heitch & Bitton, [September 1931]; USDI, NPS, "Standard Government Form of Invitation for Bids," 13 August 1931; all in Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL.

30. USDI, NPS, "Bid, Contract, and Bond for National Park Road Construction, Grand Canyon--Desert View, Route 1, Placing a Seal Coat on Sections A3, B, C, D, F, G," [1931], Misc--Construction D30...Jan, 1926-Dec, 1931, GCNPL.

31. USDI, NPS, "Bid, Contract, and Bond for National Park Road Construction, Grand Canyon-Desert View, Route 1, Placing a Seal Coat on Sections A3, B, C, D, F, G," [1932]; USDI, NPS, "Standard Contract for Construction" with Jack Casson, 21 June 1932; M.R. Tillotson to the Director, acceptance letter, 13 September 1932; all in Misc--Construction D30--G.C. Desert View Road, Jan, 1932-Dec, 1940, GCNPL.

32. Superintendent's Annual Report, 1932-33.

33. W.R.F. Wallace "Preliminary Reconnaissance, Desert View-Cameron Route," August 1930; Ansel F. Hall, Chief Naturalist, "Report on Preliminary Reconnaissance of the Proposed Desert View-Cameron Highway," 14 August 1930; M.R. Tillotson to the Director, letter, 15 August 1930; all in Misc--Construction D30--Desert View-Cameron Approach Road May 1929-Dec 1931, GCNPL.

34. P.P. Patraw, Assistant superintendent, to the Superintendent, memorandum, 26 February 1931; A.E. Demaray to the Superintendent, letter, 9 March 1931; both in Misc--Construction D30--Desert View-Cameron Approach Road, May 1929-Dec 1931, GCNPL.

35. J.H. Brannan, "Location Survey Report, Cameron-Desert View Survey, Grand Canyon Route 1, Section E," [April 1931]; Thomas E. Carpenter, "Report on Inspection of Survey of the Desert View-Cameron Road, Approach Road to Grand Canyon National Park, August 16, 18, 21, and 22, 1931," 5 September 1931; Thomas E. Carpenter, "Supplemental Memorandum on Desert View-Cameron Road," 19 September 1931; M.R. Tillotson to Chief Landscape Architect, letter, 24 September 1931; all in Misc--Construction D30--Desert View-Cameron Approach Road, May 1929-Dec 1931, GCNPL.

36. M.R. Tillotson to the Director, 19 November 1931; M. R. Tillotson to Thomas Esposito & Co., 23 November 1931; John H. Edwards, Assistant Secretary, to Everly and Allison, letter, 25 November 1931; all in Misc--Construction D30...May 1929-Dec 1931, GCNPL.

37. No completion report was found for this grading project, but the author reconstructed events from weekly narrative reports of April through August 1932, Misc--Construction D30--Desert View-Cameron Approach Road, Jan 1932-Jan 1933, GCNPL. See also Superintendent's Annual Report, 1932-33, which notes the project "practically complete" by October 1.

38. Superintendent's Annual Report, 1932-33; GRCA Image #2094, 1951, GCSC. The photograph of the entrance station does not reveal the entire structure nor its location along the road, but the small road segment pictured and vegetation suggests it was located at the same site as today's station. This checking station served until replaced during the Mission 66 years.

See also, USDI, NPS, Western Regional Office, "National Park Service Rustic Architecture: 1916-1942," by William C. Tweed, Laura E. Soulliere, and Henry G. Law, February 1977, 77-81.

39. Acting Chief of Bureau [BPR] to Arno Cammerer, letter, 16 November 1933; Narrative Report, week ending 9 December 1933; both in Misc--Construction D30--Desert View-Cameron Approach Road, Nov 1933-May 1934, GCNPL.

40. From the weekly narrative reports of BPR highway engineers E.F. Strickler and J.H. Brannan, December 1933 through April 1934, Misc Construction D30--Desert View-Cameron Approach Road, Nov 1933-May 1934, GCNPL.

41. USDI, Office of National Parks, Buildings, and Reservations, "Plans for Proposed Project NR-10, Bituminous Treated Surfacing, Route No. 10--Cameron-Desert View," 20 January 1934; G.L. McLane, Highway Engineer to Chief of Bureau [BPR], letter, 8 May 1934; Oscar L. Chapman, Assistant Secretary, to New Mexico Construction Company, letter, 22 May 1934; all in Misc--Construction D30--Desert View-Cameron Approach Road, Nov 1933-May 1934, GCNPL.

42. Superintendent's Annual Report, 1932-33.

43. C.M. Carrel, "Final Construction Report on Roads and Paths, Desert View Camp Ground and Parking Area," report with sketch map, 30 July 1934, Misc--Construction--Final Report--Desert View Campground, GCNPL.

44. "Job Application and Completion Record, Job No. 701, Guard Rails (Construction)," record w/ photographs, 25 April 1939, GRCA 61773, Box 4, GCSC; Willard Bradley, Assistant engineer, to Tillotson, memorandum, 7 August 1937, Misc Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940, GCNPL.

45. W.H. Wirt, Forester, "Technical Comment, Grand Canyon National Park Roads and Trails Project Account #560, Guard Rails--South Rim," 7 August 1937; H.H. Cornell, landscape architect, "Technical Comment, Grand Canyon National Park, Guard Rails, Job Account #560, Roads and Trails," 9 August 1937; Demaray to Tillotson, letter, 22 September 1937; H.L. Bill, assistant forester, to Tillotson, memoranda, 12 October and 8 December 1937; all in Misc Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940, GCNPL.

46. "Job Application and Completion Report, Job No. 676, Parking Area (Construction)," report w/ photographs, 26 March 1938, GRCA 61773, Box 4, GCSC.

47. "Job Completion Record, Job No. 648, Parking Areas (Construction)," Record w/ photographs, 13 September 1940, GRCA 61773, Box 4, GCSC.

48. GRCA Image #s 335, 2916, 3954, GCSC; Superintendent's Annual Reports, 1935-37.

49. Superintendents' Annual Reports, 1931-39, include discussions of these travel trends and make special note of the auto caravans.

50. Superintendent's Annual Report, 1939-40.

51. Superintendent's Annual Report, 1938-39; Hillory Tolson, Assistant Director, to Tillotson, letter, 5 February 1938, Misc Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940, GCNPL.

52. W.J. Ward to Mr. [G.L.] McLane, [BPR Senior Highway Engineer], memorandum, 17 June 1939, Misc Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940, GCNPL.

53. G.L. McLane to [Acting Superintendent] J.V. Lloyd, letter, 24 February 1940; J.V. Lloyd to the Director, memorandum, 11 April 1940, both in Misc Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940, GCNPL; Superintendent's Annual Report, 1939-40.

54. W.R.F. Wallace to Mr. McLane, memorandum, 7 March 1940, Misc Construction D30...Jan 1932-Dec 1940, GCNPL.

55. Alfred C. Kuehl, Associate Landscape Architect, "Report to the Chief of Planning on Survey Inspection, Grand Canyon-Desert View Line Changes--Widening and Resurfacing," [1940], Misc Construction

D30...Jan 1932-Dec 1940, GCNPL. A relocation survey map accompanies this report.

56. Kittredge to McLane, letter, 27 August 1940; McLane to Kittredge, letter, 28 August 1940; Kittredge to the Director, memorandum, 14 December 1940; Kittredge to McLane, letter, 29 December 1940; all in Misc Construction D30...Jan 1932-Dec 1940, GCNPL.

57. Superintendents' Annual Reports, 1939-43. No design specs, calls for bids, narrative reports, nor completion reports were found for this project. It is very possible that America's entry into World War II limited what might be considered nonessential paperwork such as this. H.C. Bryant's annual reports of 1941-42 and 1942-43 mention no contractor, and it was common practice to do so if one was involved with park road construction.

58. Superintendent's Annual Reports, 1942-46. Superintendent Bryant's reports during the war years amply reveal the park's war time footing: fewer staff, fewer tourists, fewer maintenance dollars.

59. NP-G.C. 2235, "Grandview Point Parking Layout," sketch drawing, 31 January 1946; NP-G.C. 2233, "Lipan Point Parking Layout," sketch drawing, 31 January 1946; NP-G.C. 2236, "Yaki Point Parking Layout," sketch drawing, 31 January 1946; NP-G.C. 2234, "Moran Point Parking Layout," sketch drawing, 30 October 1945; copy of all in Professional Services; Superintendent's Annual Report, 1946-47.

60. Superintendent's Annual Report, 1945-46.

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63. E.E. Erhart, DOC, BPR, "Reconnaissance Report Proposed Location of East Rim Drive, Route 1," report w/map, January 1955, D30 East Rim Drive 1954-1956, GCNPL.

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65. Robert G. Hall, Supervising Landscape Architect, to Chief, Western Office, Division of Design and Construction, memorandum, 28 April 1955; Patraw to Chief, Western Office, memorandum, 17 June 1955; both in D30 East Rim Drive 1954-1956, GCNPL.

66. Hall letter, 28 April 1955.

67. Hall letter, 28 April 1955.

68. B.M. French, "Notice to Bidders," [April 1956], D30 East Rim Drive 1954-1956, GCNPL.

69. Thomas J. Allen, NPS Assistant Director, to Assistant Secretary D'Ewart, letter, 1 May 1956, D30 East Rim Drive 1954-1956, GCNPL.

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72.DOC, BPR, "Final Construction Report, 1956-1957," attached photographs.

73. DOC, BPR, "Final Construction Report, Grand Canyon 1-A (Por), and 2-D (Por), East Rim Drive and South Entrance Road, Bituminous Surfacing," [1957], GRCA 61773, Box 5, GCSC.

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75. USDI, NPS, "Interpretive Signs and Directional Markers, East Rim Drive & South Entrance Road," February 1958, GRCA 61773, Box 6, GCSC.

76. Charles E. Krueger to Chief, Western Office, memorandum [inspection report], 17 May 1956, D30 East Rim Drive 1954-1956, GCNPL.

77. Krueger letter, 17 May 1956.

78. DOC, BPR, "Final Construction Report, Grand Canyon National Park 1-A14, B9, East Rim Drive," 1959-1960, GRCA 61773, Box 5, GCSC.

79. DOC, BPR, "Final Construction Report, 1959-1960"; USDI, NPS, "Roadside Parking Areas, East Rim Drive," working drawings, May 1959, NP-G.C. 3412, copy in Professional Services, GCNP. These drawings show the details of the proposed parking areas, but the final construction report notes that two of these were deleted from the project, and a new one added. The parking areas actually built are identified in the text of this report.

80. DOC, BPR, "Final Construction Report, 1959-1960."

81. DOC, BPR, "Final Construction Report, 1959-1960"; USDI Information Service, "Contract Awarded for Reconstruction and Relocation of Section of East Rim Drive in Grand Canyon National Park," press release, 7 October 1959, Reference File--Roads, GCNPL; Superintendent's Annual Report, 1947-48.

82. USDI, NPS, "Traffic and Interpretive Signs and Striping, East Rim Drive," final construction report, July 1961, GRCA 61773, Box 5, GCSC.

83. DOC, BPR, "Final Construction Report, Grand Canyon National Park 1-B10-10 (5), East Rim Drive and East Entrance Road, Grading, Base Course, and Bituminous Surfacing," 1961-1963, GRCA 61773, Box 5, GCSC.

84. DOC, BPR, "Final Construction Report, 1961-1963."

85. USDI, NPS, "East Rim Drive and East Entrance Road, Base, Grade, Surface, Realignment, Reconstruction, 5.8 Miles, R-84-1 (Compl), Construction Parking Areas, Grandview, Moran and Lipan Points, Grade, Base, Surface, R-91-1," October 1963, GRCA 61773, Box 5, GCSC.

This grandiose sounding report is a very short and simple summary of costs of several projects completed December 1961-October 1963. It contains only one page of narrative on the day labor projects, and a few photos of the completed roadway.

86. USDI, NPS, "Interpretive Signs and Markers, East Rim Drive, R-89 (Comp.)," construction report with photos, June 1963, GRCA 61773, Box 6, GCSC.

87. USDI, NPS, "Work Order No. 5103 GRCA, Extend Campground Roads & Spurs, Mather Area--Construct Campground Roads & Spurs, Desert View," a fixed property data record with attached photos, [1968], GRCA 61773, Box 5, GCSC.

88. USDI, NPS, "Entrance Station--East Gate B-152, Construct Two Comfort Stations [Mather Campground] B-189," completion report with photos, February 1964, GRCA 61773, Box 1, GCSC; USDI, NPS, "Entrance Station Plaza, Desert View," plan and elevation drawings, March 1961, NP-G.C. 3537, copy in Professional Services, GCNP.

89. USDI, NPS, "Entrance Station--East Gate..., February 1964"; USDI, NPS, Entrance Station Plaza drawing, March 1961.

90. USDI, NPS, Entrance Station Plaza drawing, March 1961.

91. Joe Bice, GCNP Roads Supervisor, interview by the author, 28 July 1994, tape recorded.

92. USDI, NPS, "Plans for Proposed Project 11(1), Rehabilitation & Parking Areas, East Rim Drive," drawing and specifications, April 1990, NPS Drawing No. 113/41,993, copy in Professional Services, GCNP.

These drawings include "as constructed" general information about the 1985 project, but only plans and specifications for the second segment beginning at Station 732+00. Field observations and assumptions are used with these drawings to sketch out the work completed in the first two segments of recent reconstruction.

93. Joe Bice interview, 28 July 1994.

94. USDI, NPS, "Plans for Proposed Project 11(1)," Sheets 5 and 6.

95. USDI, NPS, "Plans for Proposed Project 11(1), Sheets 7-10.

96. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 2.

97. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 5.

98. USDI, NPS, "Plans for Proposed Project 11(1), Sheets 12, 15.

99. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 11.

100. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 13.

101. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 14.

102. USDI, NPS, "Plans for Proposed Project 11(1)," Sheet 16.

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Misc--Construction D30--Desert View Road Nov 1923-Nov 1927

Misc--Construction D30--G.C. Desert View Road, Jan 1926-Dec 1931

Misc--Construction D30--G.C. Desert View Road, Jan 1932-Dec 1940

Misc--Construction D30--Desert View-Cameron Approach Road, May 1929-Dec 1931

Misc--Construction D30--Desert View-Cameron Approach Road, Jan 1932-Jan 1933

Misc--Construction D30--Desert View-Cameron Approach Road Nov 1933-May 1934

Misc--Construction--Final Report--Desert View Campground

Misc--Old Roads & Trails In The Park 1923-1944

Reference File--Roads

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HISTORIC AMERICAN ENGINEERING RECORD

INDEX TO PHOTOGRAPHS

EAST RIM DRIVE
(Grand Canyon Route #1 and #10)
~~(Grand Canyon--Desert View Road)~~
Between South Entrance Road and east park boundary
Grand Canyon National Park
Coconino County
Arizona

HAER No. AZ-44

Brian C. Grogan, photographer, 1994

AZ-44-1 OLD EAST ENTRANCE ROAD WITH NEW ROAD AT LEFT, AT MILE 2.6 FROM OLD ROAD ACCESS INTERSECTION, FACING ENE.

AZ-44-2 ROAD FILL FOR NEW HIGHWAY SEEN FROM OLD ROAD AT MILE 1.5 FROM OLD ROAD ACCESS INTERSECTION, FACING NNW.

AZ-44-3 DOUBLE BOX CULVERT ON OLD ROAD AT MILE 1.1 FROM OLD ROAD ACCESS INTERSECTION, FACING NW.

AZ-44-4 CULVERT IN OLD ROAD AT MILE 0.8 FROM OLD ROAD ACCESS INTERSECTION, FACING NNW.

AZ-44-5 BOX CULVERT ON OLD ROAD AT MILE 0.4 FROM OLD ROAD ACCESS INTERSECTION, FACING NNW.

AZ-44-6 CULVERT ON ENTRANCE ROAD EAST OF PARK BOUNDARY, FACING WNW.

AZ-44-7 PARK ENTRANCE SIGN, FACING NW.

AZ-44-8 EAST RIM DRIVE ENTRANCE STATION, FACING NNE.

AZ-44-9 EAST RIM DRIVE ENTRANCE STATION, FACING SSW.

AZ-44-10 WATCH TOWER, FACING N.

AZ-44-11 LIPAN POINT VIEW, FACING W.

AZ-44-12 LIPAN POINT INTERPRETIVE EXHIBIT, FACING SW.

AZ-44-13 LIPAN POINT OVERLOOK, FACING NW.

AZ-44-14 ROAD TRANSITION ZONE AT TUSAYAN RUINS, FACING NNE. NOTE CHANGE IN SHOULDER.

AZ-44-15 ROAD VIEW APPROXIMATELY 2 MILES EAST OF MORAN POINT, FACING NNW. NOTE DROP CULVERT ON FAR SIDE OF ROAD.

AZ-44-16 ROAD VIEW APPROXIMATELY 2 MILES EAST OF MORAN POINT, FACING ESE.

AZ-44-17 YAKI POINT VIEW, FACING NW. (OUT OF GEOGRAPHIC SEQUENCE; SHOULD BE AT END OF SET.)

AZ-44-18 MORAN POINT, WALL DETAIL, FACING WNW.

AZ-44-19 MORAN POINT, WALLL DETAIL, THE GOOD AND THE UGLY, FACING N.

AZ-44-20 ROAD VIEW AND CURBING ON BUGGEN HILL, FACING SE.

AZ-44-21 BUGGEN HILL PICNIC AREA, FACING NE.

AZ-44-22 CURBING ON BUGGEN HILL WEST OF PICNIC AREA, FACING SW.

AZ-44-23 GRAND VIEW PARKING AREA, FACING SE.

AZ-44-24 GRAND VIEW POINT, FACING NNW.

AZ-44-25 GRAND VIEW SPUR ROAD, FACING SW. NOTE OLD ROAD ALIGNMENT AND REVEGETATION TO RIGHT.

AZ-44-26 OLD WALL, NEW CURBING, NEW RAIL POSTS AT FIRST LARGE TURNOUT EAST OF YAKI POINT, FACING NNW.

AZ-44-27 DROP CULVERT IN PARKING AREA AT FIRST LARGE TURNOUT EAST OF YAKI POINT, FACING NW.

AZ-44-28 YAKI POINT SPUR ROAD, FACING SW.


HABS NO. AZ-44-1

HAER NO. AZ-44-2

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HAER No. AZ-44-4


AZ-44-5

IMAGE NO. AZ-44-6


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AZ-44-7



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